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Pelagic Fisheries of the Western Pacific Region

1997 Annual Report

October 1998

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Honolulu Hawaii

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Prepared by the Pelagics Plan Team and Council Staff

for the

Western Pacific Fishery Management Council
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A report of the Western Pacific Regional Fishery Management Council pursuant to
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Pelagic fisheries of the Western Pacific Region — 1997 Annual Report

Introduction

Background

The Fishery Management Plan (FMP) for Pelagic Fisheries of the Western Pacific Region was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) on 23 March 1987. The Western Pacific Regional Fishery Management Council (WPRFMC or Council) developed the FMP to manage the pelagic resources covered by the Magnuson Fishery Conservation and Management Act of 1976 and occurring in the US Exclusive Economic Zone (EEZ) around American Samoa, Guam, Hawaii, the Northern Mariana Islands, and other US possessions in the Western Pacific Region (Johnston Atoll, Kingman Reef & Palmyra island, Jarvis Island, Howland and Baker Islands, and wake Island).

The objectives of the Pelagics FMP were revised in 1991. The abridged objectives are to:

- Manage fisheries for management unit species to achieve optimum yield.
- Promote domestic harvest of, and domestic fishery values associated with, Pacific pelagic management unit species, or PPMUS[1] (e.g., by enhancing the opportunities for satisfying recreational fishing experience, continuation of traditional fishing practices, and domestic commercial fishermen to engage in profitable operations).
- Diminish gear conflicts in the EEZ, particularly in areas of concentrated domestic fishing.
- Improve the statistical base for conducting better stock assessments and fishery evaluations.
- Promote the formation of regional/international arrangements for assessing and conserving PPMUS throughout their range.
- Preclude waste of PPMUS associated with longline, purse seine, pole-and-line or other fishing operations.
- To promote domestic marketing of PPMUS in American Samoa, Guam, Hawaii and Northern Mariana Islands.

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[1] The Magnuson Act was amended to allow the inclusion of tunas in US fishery management authority as of January 1992. In the Pacific, tuna management is the responsibility of the regional fishery management councils. Pacific pelagic management unit species (PPMUS) includes former pelagic management unit species (PMUS) and tunas.

The Pacific pelagic management unit species (PPMUS) are[2]:

English Common Name	Scientific Name
Mahimahi (dolphinfishes)	*Coryphaena* spp.
Wahoo	*Acanthocybium solandri*
Blue and black marlins	*Makaira* spp.
Striped marlin and shortbill spearfish	*Tetrapturus* spp
Swordfish	*Xiphias gladius*
Sailfish	*Istiophorus platypterus*
Requiem sharks (oceanic species)	family Carcharinidae
Thresher sharks	family Alopiidae
Mackerel sharks	family Lamnidae
Hammerhead sharks	family Sphyrnidae
Yellowfin, bigeye, albacore, and bluefin tunas	*Thunnus* spp
Skipjack tuna	*Katsuwonus pelamis*
Kawakawa	*Euthynnus affinis*
Frigate and bullet tunas	*Auxis* spp
Slender tuna	*Allothunus fallai*
Dogtooth tuna	*Gymnosarda unicolor*
Mackerel	*Scomber* spp
Moonfish[3]	*Lampris* spp
Oilfish family	Gempylidae
Pomfret (oceanic species)	family Bramidae

Non-tuna PPMUS are sometimes referred to as "other PPMUS" in this report. This term is equivalent to PMUS (Pelagic Management Unit Species) used in annual reports previous to 1992, before tunas were included in the management unit.

The PPMUS are caught in the troll, longline, handline and pole-and-line (baitboat) fisheries. they are caught in oceanic as well as insular pelagic waters. Most of these species are considered to be epipelagic because they occupy the uppermost layers of the pelagic zone. All are high-level predators in the trophic sense. pelagic fisheries for PPMUS are among the most important, if not the dominant Pacific Island fisheries.

The FMP requires the Council's Pelagic Plan Team (Team) to prepare an annual report on the status of the pelagic fisheries taking place in each of the island areas served by the Council (American Samoa, Guam, Hawaii and Northern Mariana Islands), to evaluate the effectiveness of the FMP in meeting its goals and objectives, and make recommendations for future management and administrative action.

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[2] Classifications in this table follow Amendment 6 to the FMP, effective 27 November 1992.

[3] Moonfish, oilfish and pomfret were added to the FMP by Amendment 7, effective 24 June 1994

Report Content

This report contains fishery performance data from each of the four island groups through 1997, interpretations of trends or important events occurring in the fisheries, and recommendations. This report was prepared using reports submitted by the following agencies . The Hawaii report is an integration of State of Hawaii Division of Aquatic Resources and NMFS summaries.

- Territory of American Samoa, Department of Marine and Wildlife Resources
- Territory of Guam, Division of Aquatic and Wildlife Resources
- Territory of Guam, Department of Commerce
- State of Hawaii, Division of Aquatic Resources
- Commonwealth of the Northern Marianas, Division of Fish and Wildlife
- National Marine Fisheries Service, Southwest Region (including Southwest Fisheries Science Center Honolulu Laboratory, Pacific Area Office and Office of Enforcement)
- US Coast Guard, District 14
- Pacific Fisheries Research Program, University of Hawaii

Report Appraisal

Report Content has not changed significantly from previous years.

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Table 1. Names of Pacific pelagic management unit species

English Common Name	Scientific Name	Samoan or AS local	Hawaiian or HI local	Chamorro or Guam local	S. Carolinian or NMI local	N. Carolinian or NMI local
Mahimahi (dolphinfishes)	*Coryphaena* spp.	Masimasi	Mahimahi	Botague	Sopor	Habwur
Wahoo	*Acanthocybium solandri*	Paala	Ono	Toson	Ngaal	Ngaal
Indo-Pacific blue marlin Black marlin	*Makaira mazara:* *M. indica*	Sa'ula	A'u, Kajiki	Batto'	Taghalaar	Taghalaar
Striped marlin	*Tetrapturus audax*		Nairagi			
Shortbill spearfish	*T. angustirostris*	Sa'ula	Hebi	Spearfish		
Swordfish	*Xiphias gladius*	Sa'ula malie	A'u kū, Broadbill, Shutome	Swordfish	Taghalaar	Taghalaar
Sailfish	*Istiophorus platypterus*	Sa'ula	A'u lepe	Guihan layak	Taghalaar	Taghalaar
Oceanic sharks	Alopiidae, Carcharinidae, Lamnidae, Sphynidae	Malie	Mano	Halu'u	Paaw	Paaw
Albacore	*Thunnus alalunga*	Apakoa	'Ahi palaha, Tombo	Albacore	Angaraap	Hangaraap
Bigeye tuna	*T. obesus*	Asiasi, To'uo	'Ahi po'onui, Mabachi	Bigeye tuna	Toghu, Sangir	Toghu, Sangir
Yellowfin tuna	*T. albacares*	Asiasi, To'uo	'Ahi shibi	'Ahi, Shibi	Yellowfin tuna	Toghu
Northern bluefin tuna	*T. thynnus*		Maguro			
Skipjack tuna	*Katsuwonus pelamis*	Atu, Faolua, Ga'oga	Aku	Bunita	Angaraap	Hangaraap
Kawakawa	*Euthynnus affinis*	Atualo, Kavalau	Kawakawa	Kawakawa	Asilay	Hailuway
Dogtooth tuna	*Gymnosarda unicolor*	Tagi	Hagatsuo	Dogtooth or white tuna	Ayul	Owel
Moonfish	*Lampris* spp	Koko	Opah		Ligehrigher	Ligehrigher
Oilfish family	Gempylidae	Palu talatala	Walu, Escolar		Tekiniipek	Tekiniipek
Pomfret	family Bramidae	Manifi moana	Monchong			
Other tuna relatives	*Auxis* spp, *Scomber* spp; *Allothunus* spp	(various)	Ke'o ke'o, saba (various)	(various)	(various)	(various)

Table 2. Total 1997 pelagic landings[4] (in lbs) in the Western Pacific Region

Species	American Samoa	% change	Guam	% change	Hawaii	% change	Northern Marianas	% change	Total	% change
Albacore	627,613	169.7			3,900,000	30.0			4,527,613	40.06
Barracuda	9,157	102.1	2,802	-96.3			177	-24.4	12,136	18.23
Bigeye tuna	5,547	-44.6			5,500,000	5.8			5,505,547	5.67
Black marlin*	1,852								1,852	100.00
Blue marlin	41,250	9.5	87,382	30.8	1,800,000	-5.3	5,655	-17.7	1,934,287	-3.53
Bluefin tuna					100,000				100,000	0.00
Dogtooth Tuna	393	-93.4	1,858	-11.0			7,616	-27.6	9,867	-46.71
Kawakawa	369	64.0	3,256	-24.2					3,625	-15.07
Mahimahi	37,217	187.3	242,666	-25.3	1,100,000	57.1	25,021	-12.3	1,404,904	34.38
Misc billfish					400,000	0.0			400,000	0.00
Misc pelagics		-100.0	16,644	93.9	200,000	100.0	5,784	59.2	222,428	110.48
Misc tunas	388					-100.0		-100.0	388	-96.91
Moonfish	2,848				800,000	14.3			802,848	14.69
Pomfret*										
Rainbow runner*	521	-57.2	4,582	-421.6			740	-16.4	5,843	-77.53
Sailfish*	7,300	31.9					100	-81.7	7,400	21.71
Sharks	11,229	-11.9	5,238	36.1	5,000,000	11.1			5,016,467	11.08
Skipjack tuna	36,779	-51.6	206,570	-4.5	2,500,000	8.7	106,637	-19.3	2,849,986	4.62
Spearfish*										-100.00
Striped marlin					900,000	-10.0			900,000	-10.00
Swordfish	403				6,400,000	8.5			6,400,403	8.46
Wahoo	16,910	41.1	87,469	-62.4	800,000	60.0	6,064	-29.7	910,443	37.39
Yellowfin tuna	84,147	-9.8	92,571	-10.9	4,200,000	10.5	17,121	-43.7	4,393,839	9.13
TOTAL	883,923	74.3	751,038	-15.3	33,600,000	11.6	174,915	-22.2	35,409,876	11.67

* NMFS Hawaii longline logbook summaries aggregate several billfish and tuna species (noted with *) into miscellaneous billfish, tuna, and pelagics categories. All Hawaii totals shown here are NMFS estimates and rounded to the nearest 100,000 lb, except for bluefin tuna and misc. tunas.

[4] Landings are reported in island reports (Appendices 1-4), which include recreational and commercial domestic landings data, where available (e.g., for Hawaii, only commercial landings). In some cases, totals may not add precisely due to rounding. These do not include foreign transshipment or domestic cannery landings, which may be reported separately in island modules.

Summary

1) No FMP or regulatory amendments governing Western Pacific pelagic fisheries were proposed by the Council in 1997. See Administrative Activities for details. No permits were requested by any foreign nations to fish in the US EEZ of the Western Pacific Region.

Island summaries

2) In **American Samoa** pelagic fishing effort and landings of PPMUS of in American Samoa continued the upward trend which commenced in 1994. This reflects the continued interest in small scale longline fishing in the territory, targeting mainly albacore. An estimated 883,923 lb (+ 123%)[5] of pelagic fish were landed in 1997, of which 874.763 (+137%) were commercial landings valued at $ 874,763 (+137%). The average price for all pelagics was $1.11/lb (-15%).

The number of boats in the pelagic fishery during 1997 increased 20% from 1996. A total of 54 vessels made an estimated 2990 trips (+45%), comprising 817 trolling trips and 2173 longline trips. The average duration of all fishing trips was 6.8 hr/trip, similar to the 6.6 hr/trip in 1996. However longline trips were on average three hours longer than trolling trips (7.6hrs/longline trip vs 4.6 hrs/trolling trip). In contrast to 1996, where twice as many fishing trips used trolling gear, the ratio of longline to troll trips was almost 3:1 (2173 longline trips vs 817 trolling trips). Data on catch per unit of effort (CPUE) from the troll fishery suggested that the 1997 CPUE was slightly lower than in 1996, due to decreased CPUEs for most species The overall average CPUE for longline fishing in 1997 was 39.4 fish/1000 hooks, of which 31.2 fish/1000 hooks, or 79%, were albacore. Overall longline catch rates and catch rates for albacore between 1996 and 1997 showed little change.

Cannery landings at Pago Pago during 1997 comprised 88,400 t of skipjack, 22,700 t of yellowfin and 50,900 t of albacore. Most of the skipjack and yellowfin are caught in distant water fisheries, predominantly in the Western Tropical Pacific, while albacore landings are made by vessels operating in cooler waters to the south of American Samoa. Landings have remained relatively stable during the 1990s although there is a increasing trend in the volume of landed albacore, which partially reflects the increased longline fishing activity in both American and Western Samoa.

3) In **Guam** landings of all pelagics amounted to 751,038 lb (-13%), although total revenues increased to $515,007 (+39%). Other PPMUS landings declined markedly to 302,397 lb (-41%) but adjusted revenues increased to $351,229 (+31%). Tuna landings increased to 424,650 lb (+19%), with a matching increase revenues (+22%) to $154,819. The overall decrease in landings was attributed to the increase in bad-weather days, due to an extended typhoon season. Additionally, the Asian economic crisis resulted in a decrease in tourism, which impacted the charter boat sector, resulting in fewer trips and subsequently a decrease in landings. Landings in

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[5] Percentages in parentheses indicate percent change from previous year

1997 saw a reversal in a trend in Guam's pelagic fisheries towards targeting other PPMUS, principally mahimahi, rather than tuna. Tunas comprised about 57% of the 1997 pelagic landings, in contrast to 1996 where they formed only 37% of pelagic landings. Mahimahi comprised 32% of the total pelagic landings, followed by skipjack (28%), wahoo (9%), yellowfin tuna (12%) and blue marlin (12%).

Guam's adjusted prices for pelagic fish have shown a general decline since 1980, although the adjusted price ($/lb) of tuna remained static between 1996 and 1997, and non-tuna PPMUS has continued to increase since 1995 and rose by 14% between 1996 and 1997.

Virtually all the landings of pelagic fish are made by trolling vessels and the fleet size operating in the fishery in 1997 was 464 vessels (-4%). This marks a reversal of a previously markedly increasing trend in fleet size since 1980. The number of trips (14,104) and hours fished (58,881) both declined (-11%) significantly in 1997, however there was a marked increase in hours per trip (4.2, 17%) in the fishery during 1997.

Transhipment activity in Guam was markedly reduced in 1997 as a consequence of the strong El-Nino Southern Oscillation (ENSO) event.

4) The **Hawaii** fisheries for PPMUS produced total pelagic landings of 33.6 million lb in 1997, or an increase of about 16%. Swordfish landings (6.4 million lb) in 1997 were higher than in 1996 (5.5 million lb), an increase of 16%. Swordfish continued to be the dominant species (19%) in the pelagic fishery. Other major components of the pelagic fishery include bigeye (16%), yellowfin (13%) and albacore (12%), other tunas (8%), and sharks (15%). Blue marlin catches declined only slightly (-5%) from 1996 while striped marlin catches declined (-10%) in 1997, but less severely than between 1995 and 1996 (-23%). Mahimahi landings were markedly higher (+22%) in 1997, as were tuna landings which increased by about 18% The numbers of sharks retained for finning increased in 1997 and this is reflected in the estimated landed whole weight of sharks which rose by 16%.

Total pelagics revenue increased by about 10% to $ 59.4 million, although the average price per pound for pelagic fish in 1997 declined slightly (-5%). The inflation adjusted ex-vessel revenue for the longline fishery increased significantly in 1997 (+17%), while the adjusted ex-vessel revenue for the handline fishery was markedly decreased (-43%) and down by about 10% for the troll fishery. The adjusted ex-revenue for aku baitboats in 1997 remained unchanged from the previous year.

Changes in catch rate by trollers and handliners varied by species in 1997. Troll catch rates for ono (+41%) mahimahi (+18%) and yellowfin (+13%) showed marked increases in catch per trip, while catch rates between years for blue marlin (-10%) and skipjack (-14%) were somewhat reduced, but above the long term average. For handline fishing, swordfish (+50%), blue marlin (40%) and wahoo (+10%) catch rates were significantly higher in 1997, while mahimahi catch rates were similar to the previous year (+2%). All handline tuna catch rates were down in 1997,

yellowfin by -6%, albacore by -22% and -48% for bigeye tuna, and for yellowfin and particularly bigeye were below the long term averages for these species.

The Hawaii longline fleet landed 27.1 million pounds of fish, an 8% increase on the 1996 landings. Of the billfish landed in Hawaii, longlining accounted for almost all the swordfish (99.8%) and striped marlin (100%), and 61% of the blue marlin. About 30% of the longline landings (8.3 million lb) were billfish and 77% of billfish landings were swordfish. The longline fleet also accounted for most of the bluefin tuna (100%), bigeye tuna (98%), albacore (93%), moonfish (≈100%), sharks (≈100%) landed in Hawaii. Estimated shark catches continued to increase (16%) due to a greater finning activity onboard longline vessels in 1997. The bluefin landings remained unchanged between 1996 and 1997.

Fishing effort for the combined pelagic fisheries in Hawaii remained at a high level in 1995. The number of longline vessels participating in this fishery increased slightly from 103 vessels making 1,100 trips in 1996 to 105 vessels making 1,122 trips in 1997. The size of the longline fleet declined steadily between 1991 and 1996 from 141 to 103 vessels, although there are a maximum of 164 licenses available in the limited entry system. The number of trips by the troll fishery increased by 7% to 23,129, higher than the 1979-1997 average of 18,096, but relatively static over the past ten years. The number of trips taken by aku baitboats (404) declined by 8%, and probably reflects the loss in early 1998 of one of the aku boat fleet. The present level of aku boat activity, in terms of trip, is about half the long term average. The number of handline trips in 1997 (5,697) was an 11% decrease on fishing activity compared with 1996.

5) Landings of all pelagics in the **Northern Mariana Islands** (NMI) decreased significantly (-22%) between 1996 and 1997 to 174,914 lb. The principal reason for the decline is believed to be the particularly bad weather experienced in the Marianas in the last portion of 1997. A number of typhoons and super typhoons passed through the Marianas during 1997 causing severe damage on some islands and keeping fishermen off the water more than in a typical year. Skipjack landings were -19% lower (132,155) than 1996, and lower than the long term average between 1983 and 1997. Yellowfin tuna landings were markedly reduced (-44%) and only slightly above the long term average. Landings of mahimahi were down 12 % from 1996 but were still significantly higher than the long term average. Wahoo landings declined by nearly 30% but were nearly equal to the long term average. Blue marlin landings also declined markedly (-30%), but were still almost twice the long term average.

The large decreases in landings during 1997 were not reflected in total adjusted revenues which increased by about 10% ($379,145) over those in 1996. Tuna adjusted revenues rose 13%, and other PPMUS were up by a more modest 3%.

The number of fishermen making commercial pelagic landings declined slightly in 1997 to 106 (-7%), but remained well above the long term average. Similarly, the number of trips landing PPMUS declined (-9%), was still much higher than the long term average.

The inflation adjusted prices of other PPMUS and tunas have remained fairly stable since 1993, but showed marked increases in 1997, perhaps in response to the reduced landings of fish. The average adjusted price of tunas rose to $2.2/lb (+46%) and of other PPMUS to $2.07/lb (+28%), both well above the long term average.

Species summaries

6) The **swordfish** longline fishery in Hawaii began in 1989 with landings of 0.6 million lb, increasing to 3.4 million lb in 1990, and peaking at 13.1 million lb in 1993. Swordfish landings declined in 1994 and 1995 but may be leveling out and stabilizing at about 6 million lb. Landings in 1997 amounted to 6.4 million lb, slightly larger than the long term average for the fishery. The estimated average size of longline-caught swordfish was 163 lb in 1997, slightly above the 1987-1997 average (+7%). Swordfish comprised the largest proportion of the total non-tuna landings by all fisheries in Hawaii for the seventh consecutive year (37% in 1997, 38% in 1996, 38% in 1995, 60% in 1994, 72% in 1993, 73% in 1992, 62% in 1991, and 38% in 1990). The longline catch rate of swordfish in 1997 continued to increase for the third successive year, from the all-time low in 1994, and was 5% higher than the long term average between 1991 and 1997. Swordfish landings from non-longline gear were negligible in comparison (0.2%). Other areas did not report landings of swordfish, apart from a few captures in the American Samoa longline fishery.

7) **Blue marlin** catches in American Samoa continued to increase (+43%) as a result of the expansion of the longline fishery, which took 85% of the total blue marlin catch. Guam landings of blue marlin (87,382 lb) were 31% higher than 1996, ranking joint third with wahoo behind mahimahi and skipjack tuna. Blue marlin landings (1.8 million lb) in Hawaii were slightly lower than in 1996 (-6 %) at 1.8 million lb. Longliners accounted for 61 % of the total Hawaii blue marlin landings. Blue marlin landings in the Northern Marianas (5,655 lb) were significantly down on the previous year (-21.6), in common with most species, but were still nearly double the long term average between 1983-1997.

The catch rate of blue marlin in the American Samoa troll fishery was markedly lower (-25%) than in 1996, but still notably higher than the long term average. In Guam, blue marlin troll catch rate increased markedly from 1996 (+67%) and was equivalent to the long term average. In the Hawaii longline fishery blue marlin tends to be caught incidentally at a higher rates on tuna trips than swordfish trips. The catch rate of blue marlin on tuna trips remained unchanged between 1996 and 1997, and the same as the long term average. The catch rate of blue marlin in the Hawaii troll fishery increased (+29%) and was higher than the long term average. In the Northern Marianas, the 1997 marlin was lower than in 1997 (-10%) but still above the long term average.

8) **Striped marlin** landings ranked third among the billfish in Hawaii (after swordfish and blue marlin), and in 1997 it accounted for 5% of the commercial landings of non-tuna PPMUS. The 1997 landings of 0.9 million lb were (-10%) lower than 1996 landings and lower than the long-term average. Striped marlin is regarded as a secondary target species (after bigeye tuna) in the winter longline fishery, and was the third in terms of volume of total longline landings of billfish

after swordfish and blue marlin. Landings in the Hawaii troll and handline fisheries during 1997 (84,000 lb, -29%) were markedly reduced from the previous year and about 10% below the long-term average. The species rarely appears in the domestic landings from other areas.

9) **Shortbill spearfish** made up less than 1% of the PPMUS landings in Hawaii, and rarely appeared in the landings reported for other areas.

10) **Sailfish** landings were insignificant in most areas. American Samoa reported landings of 7,300 lb of sailfish in 1997, a 32% increase on 1996 landings and four times greater than the long term average.

11) **Mahimahi** landings (37217 lb) in American Samoa during 1997 rose markedly from 1996 (+187%) and were significantly higher than any time in the past. Guam's 1997 mahimahi landings (242,666 lb) were markedly reduced (-25%) on the 1996 total but still considerably higher than the long term average. Mahimahi landings in Guam have continued to display wide, unexplained annual fluctuations since 1987. The trolling catch rate for mahimahi has, however, remained relatively stable over the past three years. Mahimahi landings (1,100,000 lb) made up 6% of the 1997 non-tuna PPMUS landings in Hawaii, an increase of 57.1%. The longline fishery accounted for 45% of the 1997 landings, with the bulk of mahimahi landings coming from the combined troll and handline fisheries. The troll catch rate in Hawaii was 15% higher than the 1996 rate and above the long term average. Northern Marianas mahimahi landings declined in common with most other species and amounted to 25,021 lb (+12%). Mahimahi accounted for 56% of the total non-tuna PPMUS landings. The trolling catch rate in 1997 remained more or less unchanged from 1996 and was still slightly higher than the long-term average.

12) **Wahoo** landings in American Samoa increased to 16,910 lb (+41.1%), to the highest level yet. This increase in landings was generated mainly from the longline fishery as catch rates from trolling dropped by 38% to 0.62 lb/hr, but still higher than the long term average (0.43 lb/hr). Guam's wahoo landings (87,469lb) declined markedly by over 60 % from 1997 with catch rates dropping by 50% from 1996. Wahoo landings in Hawaii increased from 0.7 million lb to 0.8 million lb between 1996 and 1997. The 1997 trolling catch rate for wahoo in Hawaii increased by 41% from 1996, and was well above long-term average. Northern Marianas wahoo landings (6,064 lb) and catch rate (2.96 lb/trip) in lb/trip both decreased by 29% and 23% respectively. The catch was about the same as the long term average but the catch rate was significantly lower than the long term average CPUE.

13) Estimated Hawaii **shark** volume increased by 11% between 1996 and 1997. The landings reported here are only domestic landings. The increase is due to increased landings of shark fins, about 95% of which are from blue sharks. The price for blue shark fins has increased from about $15/lb in 1992 to $26/lb in 1997 while the price for other miscellaneous shark fin has increased from $20/lb in 1991 up to $50/lb in 1997[6]. Shark landings from other areas were relatively minor. Virtually the entire shark landings come from longline vessels. However, the Bottomfish Plan

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[6] Dr. Samuel Pooley, NMFS Honolulu Laboratory, pers. comm.

Team has also noted that Northwestern Hawaiian Islands bottom-fishermen also land fins of coastal and reef sharks taken incidentally [7], although the quantity has not been estimated.

14) **Yellowfin tuna** landings in American Samoa (84,147) decreased by about 10%, and catch rates were 23% lower in the troll fishery than in 1996, and slightly below the long term average. Guam yellowfin landings (92,571 lb) decreased 11% but the catch rates were the same as in 1996 and the long term average. The total Hawaii landings of yellowfin (4.2 million lb) were 11% higher than 1996 and about equivalent to the long-term average. Landings of yellowfin by trollers and handliners in 1997 were reduced by 29%, while landings by longliners increased by 79%. Trolling catch rate of yellowfin increased by 13% during 1997 and the catch rate from handline fishing declined by 6%. Longline catch rates of yellowfin by directed tuna trips were remained unchanged between 1996 and 1997, and similar to the long term average. Northern Marianas Islands yellowfin landings of 17,121 lb were much lower (-43.7%) than 1996, and the catch rates were about 38% lower than in 1996, and below the long-term average.

15) **Skipjack tuna** landings in American Samoa in 1997 (36,779 lb) represented a nearly 52% drop compared with 1996 landings, while the troll catch rate declined by 25% and was significantly below the long term average. The decline in skipjack landings is due mainly to a reduction in troll fishing, while longline fishing (which does not target skipjack) has increased. Guam skipjack landings in 1997 (206,570 lb) represented a decrease of 4.5% and catch rates were 6 higher than in 1996 Hawaii skipjack landings (2.5 million lb) rose 9 % in 1997 and were close to the long term average. The skipjack were caught principally by baitboats, which landed 1.7 million lb of skipjack in 1997, similar to the volume landed in 1996. Both troll skipjack catch rate (14%) and baitboat catch rate (+8%) rose in 1997, and were above the long-term average. Northern Marianas Islands 1997 skipjack landings were 19% lower (106,637 lb) than 1996, while the catch rate fell slightly by 11% from 1996 and was still far below the long-term average.

16) Hawaii landings of **bigeye tuna** (5.5 million lb) were 6% higher than 1996, almost all (98%) caught by longline. No other areas reported bigeye landings apart from American Samoa, where the emergent albacore fishery caught a modest 5,547 lb of bigeye tuna.

17) American Samoa reported landing 627,613 lb of **albacore** during 1997, the highest yet recorded by the American Samoa fleet and a three fold increase on 1996 landings. Hawaii total landings of albacore (3.9 million lb) was a 30% increase from 1996, and is due mainly to the increased targeting of albacore in Hawaii by longline vessels. Landings of albacore by longline vessels increased by 62% in 1997. Other areas did not report landings of albacore.

18)**Troll fisheries** continue dominated the domestic fisheries in Guam and the Northern Marianas, in contrast to American Samoa, where the emergent longline fishery now accounts for 90% of PMUS landings. Growing charter fishing businesses in Guam and Northern Marianas contributed heavily to troll fishing effort. In Hawaii, longline landings continue to dominate pelagic fisheries production and in 1997 accounted for over 80% of the landed volume of PMUS.

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[7]. WPRFMC Bottomfish Plan Team meeting, March 27-28 , 1996, Executive Centre Hotel, Honolulu, HI.

Issues

In Hawaii the issue of bycatch in the longline fishery continues to drive most of the management initiatives of the Western Pacific Fishery Council and associated agencies. The Council is concerned with longline catches of protected species such as turtles and albatross, and by the marked increase of retention and finning of blue shark by longline fishermen. Measures to improve information on the levels of turtle and seabird interactions, and to mitigate seabird mortalities were implemented in 1997. Concern over the level of blue marlin catches in the commercial fisheries in Hawaii led the Council to focus more effort on the management of this species. The emergent longline fishery in American Samoa based mainly on albacore is also major concern for the Council, which is in the process of implementing a closed area around the islands of the Territory to protect the small vessel pelagic fishing. Pelagic fisheries in both Guam and the Marianas were severely impacted by typhoons in 1997 leading to a drop in production of most species. The economic recession in Asia and subsequent decline in tourism may lead to a contraction of commercial fisheries in both locations

Recommendations to the Council

1. **The Council should request the Hawaii Division of Aquatic Resources (HDAR) to develop and implement a fish dealer permitting system, and should computerize and enforce its dealer reporting system. This will further document the total volume of fish sold in the state, and will provide a cross-reference validation capability for fishermen's reports.**

   Status: The Dealer Permitting Law now passed and administrative rule to establish the regulations currently being drafted. HDAR has accepted the recommendation of computerizing the dealer reporting system and HDAR staff have begun working with WPacFIN staff to initiate and fund this project. HDAR conducted a preliminary survey of many of the States known dealers to begin estimating the magnitude of the job and begin planning the best method to proceed.

2. **The Council and/or other appropriate agency should seek funding to conduct a survey of Hawaii small-scale fisheries. This survey is needed to evaluate the significance of non-commercial and part-time components of these fisheries.**

   Status: Request has been made to NMFS to include Hawaii and the insular territories in the Marine Recreational Fisheries Statistical Survey (MRFSS) in 1999.

3. **The HDAR should continue to improve the collection of Hawaii fisheries data so that the data provide useful information on fishing effort.**

   Status: This recommendation will now appear only in the Hawaii module recommendations

4. **The three fishery management councils with Pacific jurisdiction, along with member states and NMFS, should collaborate to ensure the collection of landing and logbook data from all domestic longline and driftnet vessels harvesting swordfish and other Pacific Pelagic Management Unit Species (PPMUS)**

   Status: Reporting of pelagic catches from all Pacific Councils: This recommendation is retained with further recommendations to standardize data reporting consistency between Councils and more sharing and exchange of data. Paul Dalzell showed data obtained from the Pacific States Marine Fisheries Commission, which will be added to the annual report in the form of an additional module.

5. **The Council should support an analysis of trends in mahimahi and ono landings and catch rates, and other incidental catches, throughout the western Pacific region, including data from EEZ and distant-water fisheries.**

   Status: This recommendation is retained.

6. **The Council should attempt to obtain data on discards from U.S. and other purse seine fisheries within the U.S. EEZ and on the high seas.**

   Status: Most of the purse seine catch analysis is covered in the Annual Report's International Module, but the information on discards, received from the PIAO by the Council, needs to be added.

Plan Administration

Administrative Activities

There were no FMP or regulatory amendments developed by the Western Pacific Fishery Management Council for pelagic fisheries during 1997. Therefore, no regulatory action related to the pelagics FMP was required by the NMFS Southwest Region, Pacific Islands Area Office (PIAO).

As requested by the Council at its 94th meeting, the PIAO prepared and submitted for publication in the Federal Register a control date of November 13, 1997 governing the pelagic longline fishery in American Samoa. The control date was published in January 1998 (3532 FR 63, January 23, 1998).

Longline Permits

During 1997, 164 permits, the maximum allowed under the FMP, were maintained in the Hawaii longline limited entry fishery. Administrative activities at PIAO primarily involved the transfer

of 25 Hawaii longline limited permits. PIAO also processed and issued Western Pacific general longline permits for the pelagic fisheries in American Samoa (33 permits), Guam (2 permits), and the Commonwealth of the Northern Mariana Islands (1 permit). The number of longline permits issued in American Samoa was double the number issued (16) in 1996.

The names of vessels registered with Hawaii limited entry and Western Pacific longline permits and permit holders are listed in Table 3.

Foreign Fishing Permits

No administrative actions relating to foreign fishing in the western Pacific EEZ were required because no foreign fishing permits were requested for any vessels with which the US has a Governing International Fishing Agreement.

Table 3. 1997 Hawaii longline limited entry permit holders

Hawaii limited entry longline fishery

VESSEL	PERMIT HOLDER
F/V ALEUTIAN SPRAY	Kristofer Knutsen
F/V ANNA	MTA Corp.
F/V ARROW	David Kelly
F/V AUKAI VI	Ralph Takafuji Sr.
F/V B-52	B-52 Inc.
F/V BARBARA H	Arthur/Barbara Haworth
F/V BIG AL	R & R Fisheries Inc.
F/V BIG DEAL	Roy-Al Boat Mgmt.
F/V BLUE DRAGON	B Dragon Corp.
F/V BLUE FIN	Liet An Lu/Mai Thi Do
F/V BLUE SKY	Blue Sky Fishing Prod
F/V BRANDI	Success Inc.
F/V CAPT. DAVIS	Ho Son Nguyen
F/V CAPT. DIAMOND	Capt. Diamond Inc.
F/V CAPT. GREG	Aquanut Co. Inc.
F/V CAPT. LE	L & T Fishery Corp.
F/V CAPT. MILLIONS I	Nga Van Le
F/V CAPT. MILLIONS III	Capt.Millions III Inc.
F/V CAPT. MILLIONS IV	H and M Fishery Inc.
F/V CAPT. WASHINGTON I	Capt.Washington I Inc.
F/V CHRIS	Kan-Do Pesca Inc.
F/V COMMANDER	Sang Van Tran
F/V CORI DAWN	Cori Dawn Corp.
F/V CRYSTA	F/V Crystal Inc.
F/V DAE IN HO	KYL Inc.
F/V DAEINHO III	Chunha Inc.
F/V DASHER II	DukSung Fishing Inc.
F/V DAWNING STAR	Larry B. & Dawn Powers
F/V DEBORAH ANN	Amko Fishing Co. Inc.
F/V DOUBLE D	Joseph Dettling
F/V E.T.	Vessel Mgmt.Assoc.Inc.
F/V EDWARD G	Edward G. Co. Inc.
F/V ESTHER I	Yong Sang Kim
F/V FINBACK	Finback Inc.
F/V FIREBIRD	Firebird Fishing Corp.
F/V GAIL ANN	Gail Ann Co. Inc.
F/V GARDEN SUN	Muoi Peter Ngo
F/V GLORY	Roy Yi
F/V GOLDSTAR\	Sapphire USA Inc.
F/V GRACE	Sang Yeol Kim
F/V HAVANA	Thomas Webster
F/V HAWAII POWER	Hawaii Power Inc.
F/V HEOLA	H & M Marine Inc.
F/V HOKUAO	White Inc.
F/V INDEPENDENCE	Independence Inc.
F/V IOLANI	All Star Fishery Inc.
F/V JAGUAR T-L	Jaguar Inc.
F/V JANTHINA	Trans World Marine Inc
F/V JENNIFER	Kil Cho Moon
F/V JI YONG	Hyon Su Oh
F/V JOHN KENNEDY	Kinh Nguyen
F/V KAIMI	James Cook
F/V KASATKA	Artemon Basargin
F/V KATHERINE II	K.A. Fishing Co. Inc.
F/V KATHERINE III	Song Fishing Corp.
F/V KATY MARY	Vessel Mgmt. Assoc Inc
F/V KAY	K.Y. Fishing Inc.
F/V KELLY ANN	Kelly Ann Corp.
F/V KEMA SUE	Kema Sue Inc.
F/V KILAUEA	Aukai Fishing Co.Ltd.
F/V KIM THANH I	Kim Thanh I Inc.
F/V KIMMY I	Kim Tran
F/V KING DIAMOND II	Scotty Nguyen
F/V KINGFISHER	Quan Do
F/V KINUE KAI	Awahnee Oceanics Inc.
F/V KOLEA	Paik Fishing Inc.
F/V LADY ALICE	Lady Alice Co. Inc.
F/V LADY CHRISTINE	Christine Tran
F/V LADY CHRISTINE II	Christine Tran Inc.
F/V LADY CHUL	Jong Ik Fishing Co Inc
F/V LADY LYN III	Lady Lyn Inc.
F/V LEA LEA	M.S. Honolulu Inc.
F/V LIBERTY	Yu & AAS Corp.
F/V LIHAU	White Inc.
F/V LILA	Samuel Lee
F/V MAN SEOK	KMC & PCC Inc.
F/V MANA LOA	Hawaii Protect Assc Lt
F/V MARIE M	Viking V Inc.
F/V MARINE STAR	Viking V Inc.
F/V MIDNIGHT II	Albert K. Duarte
F/V MISS AGGIE N	Miles Gould
F/V MISS JESSICO	Pacific Seafoods Inc
F/V MISS JULIE	Quan Do
F/V MISS LISA	Miss Lisa Inc.
F/V MISS VIVIANA	Nguyen Hai Thanh/Reagan/Duoc
F/V MOKULELE	Robert Cabos
F/V NEW HORIZON	John D. Gibbs
F/V NORPAC	George Rains Jr.
F/V NORTHERN VENTURE	Roy-Al Boat Mgmt.
F/V OCEAN DIAMOND	Ocean Diamond Inc.
F/V OPAL IMAGE	Pacific Fishing Supply
F/V PACIFIC DREAM	Pacific Seafoods Inc.
F/V PACIFIC FIN	Fishrite Inc.
F/V PACIFIC HORIZON	John Gibbs
F/V PACIFIC PRIDE	Pacific Seafoods Inc.
F/V PACIFIC STAR	N. Pac Fishery Inc.
F/V PAN AM II	Pan Am K Marine Corp.
F/V PARADISE QUEEN II	Katrianna Pacific Corp
F/V PEARL HARBOR II	Gilbert DeCosta
F/V PETITE ONE	Ka'upu Ltd.
F/V PHI NAM	Pilgrim Truong
F/V PIKY	M/V Piky Inc.
F/V PRINCESS K	Princess K Fish Corp
F/V QUEEN DIAMOND	Santa Maria III Inc.
F/V RED DIAMOND	Xuan Nguyen
F/V RED OCTOBER	Pacific Fishing Supply
F/V ROBIN	Fat City Fishing
F/V ROBIN II	Robin Fishing Inc.
F/V SANDY DORY	Highliner Inc.
F/V SAPPHIRE	Hanh Thi Nguyen
F/V SEA BIRD	Ly Hoa Van
F/V SEA DIAMOND	Nancy Nguyen
F/V SEA DIAMOND II	Sea Diamond II Inc.
F/V SEA DRAGON	Long Thanh Nguyen
F/V SEA HAWK	Hawaii Fishing Co.
F/V SEA MOON	Sea Flower Inc.
F/V SEA SPIDER	Paul Seaton, Trustee
F/V SEA SPRAY	Parker Seafoods, Inc.
F/V SEASPRAY	Hanson/Hanson Fish Co
F/V SEEKER II	Seeker Fisheries Inc.
F/V SEVEN STARS	Kwang Myong Co. Inc.

F/V SOUTH PACIFIC	South Pacific Fishing
F/V SPACER K	Hwa Deog Kim
F/V SUN FLOWER #1	TX, Inc.
F/V SUN STAR	Sun Fishing Co. Inc.
F/V SUNFLOWER III	Le's Brothers Fish Inc
F/V TUCANA	Pacific Boat Corp. Inc
F/V ULHEELANI	Ulheelani Corp.
F/V VAN LOI	Van Loi Corp.
F/V VICTORIA	Victoria Inc.
F/V VIRGINIA CREEPER	Sylvan Seafoods Inc.
F/V VOSTOK	Evgeny Basargin
F/V VUI VUI II	Vui Vui,A Limited Part
F/V VUI-VUI	Santa Maria III Inc.
F/V WHITE NIGHT	Natalia/Kiril Basargin
F/V WONIYA	Sierra Fisheries Inc.

Hawaii longline permit holders without vessels

PERMIT HOLDER
CKM Inc.
Che Kun Kim
Ocean Associates Corp.
Theodore Benjestorf
Hanh Thi Nguyen
Henry Niemi Jr.
James Chan Song Kim
John Romero
Vedoy Enterprises Inc.
David B.H. Ho
William Sullivan
Hanh Thi Nguyen
Allen Merritt
Finback Inc.
H&M Marine Inc.
Minh Hoang Dang
M&T Fishing Co. Inc.
Vessel Management Assoc.
Master Vincent Inc.
Shaman Partnership
Hana Like Inc.
L & B Fisheries Inc.
Richard Enslow
Lindgren-Pitman Inc.
Richard Enslow
Pacific Fishing Supply
John Romero

1997 Western Pacific General Longline Permit

American Samoa Pelagic Fishery

VESSEL	PERMIT HOLDER
F/V 38 SPECIAL	Peter Reid
F/V AAONE	Asaua Fuimaono
F/V ALIA O SINA	Afoa Moega Lutu
F/V AMIGO	Jay Vaoalii
F/V DOS GRIS	George Poysky III
F/V EAGLE II	Steve Haleck
F/V FAISUA	Sui Aveina
F/V FAIVAIMOANA I	Faivaimoana Fishing Co Lt
F/V FOTOLUPE	Lautogia Taula
F/V FUATINO	Nana Aveina
F/V GREEN PEACE I	Maselino Ioane
F/V GREEN PEACE II	Maselino Ioane
F/V GREEN PEACE III	Maselino Ioane
F/V ISABELLA	Jose Lugo
F/V LADY HERMINA	Jadran Satalic
F/V LADY LU	Lu's Fish Grotto
F/V LADY POLATAI	Tagaimamao Masaniai
F/V LADY VICTORIA	Violina Lin
F/V LADYSMITH	Coastal&OffshorePac Corp
F/V MALIA	Uili Talimao
F/V MARY EMMILY	Malua/Henry Nickel
F/V MISS MIHI	Timothy Jones
F/V MONA OF THE OCEAN	Terry Chang
F/V NORTH STAR	Richard Mathisen
F/V NORTHWEST	Frank McCoy Sr.
F/V OFIRA	Asaua Fuimaono
F/V REEL CAT	Dave Haleck
F/V SEA MASTER	Violina Lin
F/V SILVER BULLET	David Pedro
F/V SOUTH WIND I	Elvin Mokoma
F/V SOUTH WIND II	Elvin Mokoma
F/V SOUTH WIND III	Elvin Mokoma
F/V SOUTH WIND IV	Elvin Mokoma

Guam Pelagic Fishery

VESSEL	PERMIT HOLDER
F/V ATALOA	Jim/Nathan Elliott
F/V KARIYUSHI	Guam Y.T.K. Corp.

Commonwealth of the Northern Mariana Islands Pelagic Fishery

VESSEL	PERMIT HOLDER
F/V CHARITO	Renato Azucenas

Protected Species Conservation

In 1997 the Southwest Region's (SWR) Observer Program placed observers on Hawaii-based longline vessels covering 40 fishing trips from January 1, 1997 through December 31, 1997, for a coverage rate of about 3.6%. Thirty-eight trips were completed during the calendar year with 18 trips recording sea turtle interactions and 20 trips without interactions.

Total observed fishing effort was approximately 585,763 hooks, and 507 sets; 40 sea turtle and 5 marine mammal interactions were observed.

Loggerhead turtles were the species most often involved in observed interactions (Table 4) with longline gear, followed by leatherbacks and then olive ridleys. Of the 40 turtles observed taken, 38 were released alive. Two turtles (a leatherback and an unidentified hard shell) were released with their disposition/condition unconfirmed (Table 4).

Table 4. Observed longline gear/turtle interactions, 1997

Turtle species	Condition	
	Released alive	Released, disposition unknown
Loggerhead	24	0
Olive Ridley	3	0
Leatherback	11	1
Unidentified hardshell	0	1
Green	0	0
Hawksbill	0	0
TOTAL	38	2

Estimates of total incidental turtle take and mortality for the longline fleet has continued to be a problem for the NMFS Honolulu Laboratory. This is due in part to the low observer coverage (<5%), the rarity of longline-turtle interactions and the different targeting strategies of the elements that comprise the longline fleet. During 1998, the NMFS Honolulu Laboratory produced a report[8] which included the most statistically reliable estimated takes and kills of

[8]. Kleiber, P. 1998. Estimating annual takes and kills of sea turtles by the Hawaiian longline fishery, 1991-97, from observer program and logbook data. Honolulu Laboratory, Southwest Science Center, National Marine Fisheries Service, NOAA, Administrative Report H-98-08, 15 pp.

turtles in the longline fishery based on a classification and regression tree model. These estimates and the allowable take and kill levels, determined from the 1994 biological opinion under Section 7 of the Endangered Species Act, are given in Table 5.

Table 5. Estimated fleet-wide turtle takes and kills in the Hawaii longline fishery, 1991-1997

Species	Allowable take	Estimated takes						
		1991	1992	1993	1994	1995	1996	1997
Loggerhead	305	355	514	581	476	376	426	284
95% CL		215-462	295-624	360-770	237-558	191-461	207-502	150-435
Olive Ridley	152	118	108	115	101	110	109	111
95% CL		49-184	46-169	47-178	41-157	45-170	45-170	48-175
Leatherback	271	190	173	185	162	176	175	178
95% CL		119-268	108-245	115-261	101-229	110-249	109-247	111-251
Green	119	31	28	30	27	29	29	29
95% CL		7-58	5-52	6-56	5-49	6-53	5-52	6-54

Species	Allowable kills	Estimated kills						
		1991	1992	1993	1994	1995	1996	1997
Loggerhead	46	62	90	102	83	66	75	50
95% CL		33-85	46-117	58-145	38-103	31-83	32-92	23-74
Olive Ridley	41	30	27	29	26	28	28	28
95% CL		11-50	9-46	10-48	9-43	10-47	10-46	10-47
Leatherback	23	8	7	8	7	7	7	7
95% CL		0.1-21	0.1-19	0.1-20	0.1-18	0.1-19	0.1-19	0.1-20
Green	18	0.5	0.5	0.5	0.4	0.5	0.5	0.5
95% CL		0.04-1.01	0.04-0.92	0.04-0.98	0.03-0.86	0.04-0.94	0.03-0.92	0.03-0.94

SWR observers also obtained turtle tissue samples for genetic analyses, tagged and photographed turtles for future identification, and collected turtle life history data when possible.

Under the Honolulu Laboratory's Marine Turtle Research Program (MTRP), satellite transmitters were placed on 9 loggerhead and 3 olive ridley turtles to investigate their post-release movements and survival in 1997. Preliminary reports from the MTRP indicate transmission durations ranging from approximately 7 days to 6.5 months. The cessation of signals may be due to a number of different factors (battery life/failure, transmitter/antenna failure, predation, post-release mortality, etc.) which are currently under investigation.

Marine mammal and seabird interactions were also recorded by the observers and are summarized below in Tables 6 and 7.

Table 6. Observed longline gear/marine mammal interactions, 1997

Marine mammal species	Condition	
	Released alive	Released dead
False killer whale	1	0
Risso's dolphin	2	0
Spinner dolphin	1	0
Short-finned pilot whale	0	1
TOTAL	4	1

Table 7. Observed longline gear/seabird interactions, 1997

Seabird species	Condition	
	Released alive	Released dead
Laysan albatross	19	43
Black-footed albatross	24	86
TOTAL	43	129

Initial expansions of the seabird takes suggest that between 1000-2000 of each species of albatross are killed by the Hawaii longline fishery each year. The NMFS Honolulu Laboratory is currently investigating the most appropriate statistical method to expand the observed albatross mortalities to the entire fleet, in the same manner as was accomplished for turtles.

Habitat Protection

A major El-Nino-Southern Oscillation (ENSO) event commenced in the tropical Pacific towards the end of 1996 and continued through much of 1997. As expected during a strong ENSO year, the focus of pelagic fishing in the tropical Pacific shifted eastwards from the waters between New Guinea and Micronesia, to the central Pacific between 170°E and 160°W. This had important consequences for Guam, where port calls by purse seine and longline vessels were markedly reduced. Conversely, purse seine vessels were able to operate in waters immediately to the north of American Samoa and hence reduce transit times too and from the Pago Pago canneries.

USCG and NMFS Enforcement Activities

NMFS Enforcement Activities

The USCG conducted 1498. hours of fisheries patrols with C-130 aircraft in the Central and Western Pacific during 1997. The C-130 surveillance of the eight non-contiguous EEZ s was broken down as follows: 76.4 hours in the Main Hawaiian Islands; 77.3 hours in the Northwest Hawaiian islands; 345 hours in Guam and the Northern Mariana Islands; 11 .4 hours in Johnston Atoll; 71.5 hours in American Samoa; 167.2 hours in Palmyra Atoll/Kingman Reef 243.9 hours in Jarvis Island; 2842 in Howland/Baker Islands; and six hours in Wake Island. There were also 215.2 hours flown in direct support of High Seas Driftnet (HSDN) enforcement. The USCG flew 331.6 hours with HH-65 helicopters in support of fisheries operations; this effort was concentrated in the Main Hawaiian Islands and while deployed on high endurance cutters. During 1 997, a drastic reduction in assigned high endurance cutter days resulted in only 60 days used patrolling the U.S. EEZ in this region.

In 1997. there were 327 total fishing vessel boardings within the Fourteenth USCG District. A breakdown of vessels boarded is as follows: 195 were U.S. 42 were Japanese, 53 were Taiwanese, 15 were South Korean, and 22 were of other nationalities.

There were five significant (non-VMS) fisheries enforcement cases involving foreign fishing vessels in 1997. The following information applies:

> On 6 June, the PU YU No. 6026 was detected illegally fishing with large-scale HSDN nearly 1000 miles northeast of Midway Island. Since no USCG vessel was in a position to respond to the illegal activity, C-130 aircraft maintained surveillance of the vessel until a Fisheries Agency of Japan patrol vessel was able to respond. Due to uncertain nationality of the vessel, the FAJ was unable to conduct a boarding. The vessel entered the PRC territorial sea after 17 June. A case package documenting the incident was forwarded, via the State Department, to the PRC. PRC fisheries officials have reportedly acted on the case package and seized the vessel.
>
> On 26 June, a Canadian P-3 aircraft detected the HSDN vessel CAO YU No. 6025 illegally fishing with large-scale HSDN nearly 1500 miles northeast of Midway Island. The cutters BASSWOOD and CHASE intercepted the vessel. The vessel aggressively attempted to avoid an at-sea enforcement boarding. but was eventually boarded on 9 July. The vessel was seized and taken to Guam. The vessel and its catch were forfeited and the master was prosecuted for hindering a Coast Guard boarding.
>
> On 29 June. CGC SASSAFRAS boarded FFV SHIN CHANG No. 502 while in port at Pago Pago, American Samoa. SASSAFRAS uncovered five separate EEZ incursions in the U.S. EEZ of Palmyra Atoll in May and June 1997. The vessel was seized on 5 August. The vessel's owner paid a 100,000 dollar fine, forfeited 18,000 dollars worth of

catch and agreed to install and maintain a Vessel Monitoring System (VMS) for a period of five years.

On 23 July, CGC GALVESTON ISLAND boarded the FFV CHIN HSIN LONG No. 20 and uncovered a Lacey Act violation. The vessel's logs showed that they had fished in the EEZ of Papua New Guinea without a permit. NMFS investigated the crime and assessed a 10,000 dollar fine.

On 31 July, a USCG-130 detected the FFV SOUTH STAR fishing illegally in the U.S. EEZ of Howland/Baker Islands. The vessel abandoned their longline gear and departed the EEZ. Since no USCG cutter was able to respond. the C-130 documented the violation and a case package has been sent through the State Department to the flag state (Belize) for action.

Meetings and Conferences

Throughout 1997 the Fourteenth District Law Enforcement Branch actively participated in meetings and conferences in support of living marine resources. These events ranged from informal gatherings to multi-lateral high level conferences. Significant attendance were: The Forum Fisheries Agency s (FFA) Monitoring, Control, and Surveillance Working Group meeting and the Maritime Surveillance Seminar in April; the Second Multi-Lateral High Level Conference on the Management of Highly Migratory Species in the Western and Central Pacific Ocean in June; the Pacific Insular Area Fisheries Agreement discussions in July; the Workshop on the Legal Aspect of VMS in September; and the MLHLC Technical Consultation on Fisheries Management Issues in November.

Partnerships

In 1997 the USCO worked to strengthen its international partnerships. Specifically, Fourteenth District Law Enforcement continued to share USCG cutter and aircraft patrol information within Australia and New Zealand. Sighting data was shared with the Pacific island countries, via the FFA.

D14 conceived and executed Operation PACIFIC COMPASS, a recurring Cooperative Maritime Patrol and Self-Support Operation. involving Coast Guard cutters and aircraft, Pacific island country's patrol boats, and Australian/New Zealand Maritime surveillance aircraft. The purpose of Operation PACIFIC COMPASS is to expand District Fourteen's partnership with regional fisheries enforcement counterparts, in support of USCG program goals, and in stride with the CINC's Theater Engagement
Plan.

Vessel Monitoring System

The Hawaii VMS, monitored by NMFS and USCO, continues to be an effective surveillance and enforcement tool. In 1997 there were five significant enforcement cases cued by the VMS information. Using "signature analysis." USCG and NMFS identify possible incursions into the Main Hawaiian Island (MHI) longline closure area and the Northwest Hawaiian Island (NWI-II) Protected Species Zone (PSZ). This information is passed to patrolling cutters for investigation during an at-sea enforcement boarding. The following information applies:

On 28 February the F/V LEA LEA was observed on VMS fishing in the MHI longline closure area. CGC ASSATEAGUE conducted an at-sea enforcement boarding of the vessel and substantiated the violation.

On 28 April the F/V SUN STAR was observed on VMS, on two occasions, fishing in the MI-Il longline closure area. CGC KISKA conducted an at-sea enforcement boarding of the vessel and substantiated the violations.

On 3 July, the F/V SEA DIAMOND was observed on VMS fishing in the MHI longline closure area. CGC WASHINGTON conducted an at-sea enforcement boarding of the vessel. The boarding found that the vessel's VMS unit was operating correctly.. However, the SEA DIAMOND s log books had several discrepancies, up to 150 miles, when compared to VMS data. The vessel had logged fishing activity at times when the VMS "signature analysis" showed them to be fishing. The WASHINGTON issued violation reports for the incursion as well as falsifying log books.

On 4 July, the F/V MISS VIVIANA was observed on VMS fishing in the MHI longline closure area. CGC WASHINGTON conducted an at-sea enforcement boarding of this vessel. The boarding found that like the previous case, the vessel's VMS unit was operating correctly. Again, the log books had several discrepancies when compared to VMS data. The vessel had also logged fishing activity at times when the VMS "signature analysis" showed them to be fishing. The WASHINGTON issued violation reports for the incursion as well as falsifying log books.

On 23 September the F/V CORI DAWN was observed on VMS fishing in the MHI longline closure area. CGC WASHINGTON conducted an at-sea enforcement boarding of this vessel. The boarding found discrepancies like the previous two cases, and WASHINGTON issued violation reports for the incursion as well as falsifying logbooks.

NMFS ENFORCEMENT ACTTVITIES

Special Agents of the National Marine Fisheries Service, Office for Enforcement (OLE), conduct investigations of alleged violations of NOAA statutes and regulations, including the Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA), the Lacey Act,

the Marine Mammal Protection Act and the Endangered Species Act. During 1997, Agents were assigned to Honolulu, Hawaii and Agana, Guam. The Agents in Honolulu provided coverage for all the Hawaiian Islands while the Agents in Agana covered Guam and responded to alleged violations in the Northern Mariana Islands. A Special Agent was also assigned on a temporary duty basis to Honiara, in the Solomon Islands, for much of 1997, to assist nations that are members of the Forum Fisheries Agency. An Agent also was assigned to American Samoa in 1997 on an as-needed basis.

MSFCMA

A. Western Pacific Pelagic Fisheries

During 1997, 114 longline vessels fished in the Western Pacific Pelagic Fisheries, primarily for tunas and swordfish. In order to participate in these fisheries, vessels were required, among other things, to have a limited entry permit and to carry on board a Vessel Monitoring System (VMS). Vessels were also subject to a requirement to carry an observer. The regulations imposed reporting requirements on participants and closed approximately 160,000 square nautical miles around the northwest and main Hawaiian islands to longlining to help protect fishery stocks, and also to protect endangered species that occur in the region, particularly the Hawaiian monk seal. During the year OLE documented 23 apparent violations of the Western Pacific Pelagic Fisheries regulations.

Vessel Monitoring System

The NMFS OLE currently operates a satellite-based fishing vessel monitoring system to help determine the location and activity of vessels fishing around the Hawaiian Islands. VMS can also be used to receive catch and effort data from the fleet, transmit and receive messages, and accurately accurately locate vessels during an emergency. While VMS is currently used only for fisheries around the Hawaiian Islands, the system has potential uses in other fisheries throughout the Western Pacific, where the United States exercises jurisdiction over about 1.5 million square miles of ocean.

Statistics for 1997

• Complaints received	134
• Dockside boardings conducted in Honolulu	56
• Dockside boardings conducted in American Samoa	167
• Fisheries investigations opened	42

Appendix 1

Territory of American Samoa

Introduction

The pelagic fishery in American Samoa has historically been an important component of the traditional domestic fisheries. The fishery was first monitored in the mid 1970s and has operated on a similar small scale since that time. Prior to 1985, only commercial landings were monitored. From October 1985 to the present, data were collected through a creel survey that included subsistence and recreational fishing as well as commercial fishing. In 1997, 54 vessels participated in the fishery.

Prior to 1995 the pelagic fishery was largely a troll-based fishery. In mid-1995 four vessels began longlining and in 1997, 33 vessels had permits to longline: approximately 17 of those were actively fishing on a monthly basis. This method of fishing was introduced to the Territory by Western Samoan fishermen a few years ago. The local fishers have found longlining to be a worthwhile venture to engage in because they catch more fish with less effort and use less gas for trips. The vessels most frequently used are the "alias", twin-hulled wood (with fiberglass or aluminum) boats about 30 feet long, and powered by small gas outboard engines. Navigation on the vessels is visual, using landmarks. The gear is stored on deck on a hand-crank reel which can hold as much as 10 miles (25 miles for the jig-boat) of monofilament mainline. An average of 214 hooks per vessel per fishing-day were set in 1997. The gear is set by spooling the mainline off the reel and retrieved by hand-cranking the mainline back onto the reel. Trips are a day long (about 8 hours). Setting the equipment generally begins in the early morning; haulback is generally in the mid-day to mid-afternoon. The catch is stored in boxes built into the hull of the boat. Albacore tuna is the primary species caught, and is generally stored in personal freezers until a sufficient amount is accumulated to sell to the canneries. Some of the catch is also sometimes sold to stores, restaurants, locals and donated for family functions.

The island of Tutuila is also a major base for the trans-shipment and processing of tuna taken by the high-seas longline and purse seine fleets. The domestic pelagic fishery is monitored by the Department of Marine and Wildlife Resources (DMWR), through a program established in conjunction with the Western Pacific Fishery Information Network. This report was prepared by DMWR using information obtained by surveying pelagic fishing activities throughout the year. It does not contain information from tournament catches. The results for the pelagics fishery reported this year for 1996 differ from those reported last year. This is due to having eliminated Sundays from the expansion program as the longliners in American Samoa do not fish on Sundays. This report partially fulfills the national standard requirement for a Stock Assessment and Fishery Evaluation (SAFE) report.

Summary

During 1997, most indicators showed continued increases in landings and effort, largely due to an influx of longline vessels into the fishery. The estimated number of trips also increased in 1997, though effort and trips are split between longlining and trolling -- trolling effort and trips actually declined in 1996 and 1997. The catch per unit effort (CPUE) was similar to previous years for all species, and landings increased accordingly, coincident with increased fishing trips. Prices for pelagic species remained relatively low in 1997, possibly due to the lower prices paid for tuna by the canneries and partially due to competition by the supply of frozen fish purchased from foreign longline vessels in Pago Pago Harbor.

Catch of albacore increased dramatically in 1997, entirely due to the influx of longline. During the last half of the 1995, four boat owners equipped existing fishing vessels with monofilament longline gear, and by 1997, 22 vessels were using longline gear to fish. These vessels have been targeting albacore mostly for the cannery market and have caused the albacore harvest to increase from 232,700 pounds in 1996 to 627,600 in 1997, a 170% increase.

Recommendations

1) Continue efforts to monitor the pelagic fisheries of the local fleet in American Samoa.

2) Closely monitor the longline fleet operating in the fishery.

3) Incorporate and compare longline fisheries data from the logbooks and this creel survey.

4) Continue to work with Central WPacFIN to develop new expansion algorithms to incorporate longline fishing as a new stratum in the offshore survey.

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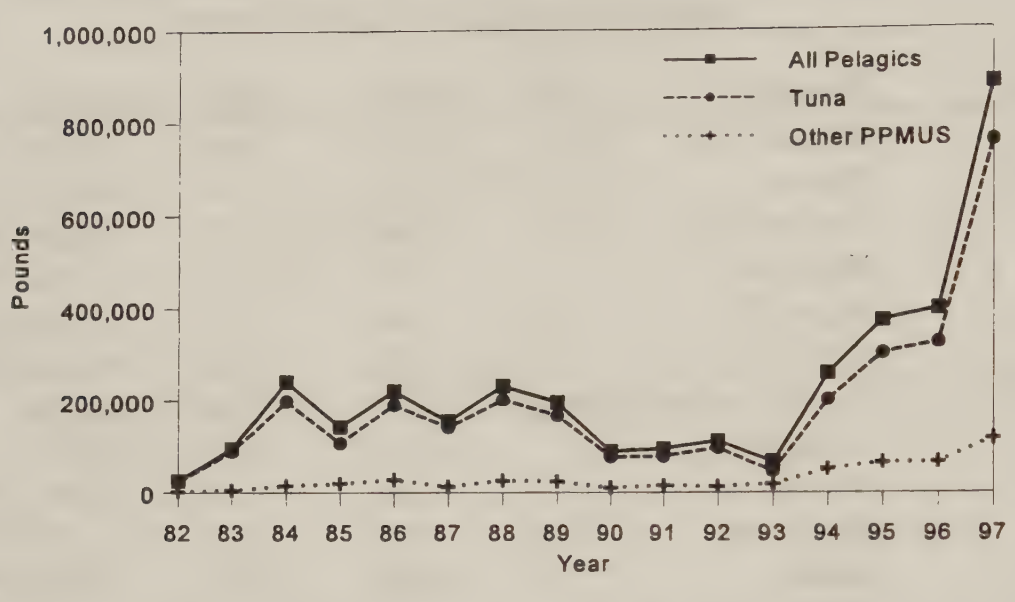
Table 1. American Samoa 1997 estimated total landings for pelagic species by gear type

Species	Longline Pounds	Troll Pounds	Total Pounds
Skipjack Tuna	2,206	34,573	36,779
Albacore	627,580	33	627,613
Yellowfin Tuna	58,475	25,672	84,147
Kawakawa	0	369	369
Bigeye Tuna	5,547	0	5,547
Unidentified Tunas	0	388	388
Subtotal Tunas	**693,808**	**61,035**	**754,843**
Mahimahi	33,106	4,111	37,217
Black Marlin	1,852	0	1,852
Blue Marlin	35,101	6,149	41,250
Wahoo	14,493	2,417	16,910
Dogtooth Tuna	0	393	393
Sharks	9,367	1,862	11,229
Swordfish	403	0	403
Sailfish	7,300	0	7,300
Subtotal other PPMUS	**101,622**	**14,932**	**116,554**
Barracuda	5,840	3,317	9,157
Rainbow Runner	29	492	521
Moonfish (Opah)	2,848	0	2,848
Subtotal Misc.	**8,717**	**3,809**	**12,526**
Total Pelagics	**804,147**	**79,776**	**883,923**

Table 2. American Samoa 1997 estimated commercial landings, value and average price of pelagic species.

Species	Pounds	$/lb	Value ($)
Skipjack Tuna	35,034	0.97	34,014
Albacore	627,611	1.10	690,372
Yellowfin Tuna	83,667	0.77	64,259
Kawakawa	63	1.00	63
Bigeye Tuna	5,546	1.25	6,933
Other Tunas	388	1.25	485
Subtotal Tunas	**752,309**	**1.06**	**796,126**
Mahimahi	36,881	1.50	55,394
Blue Marlin	38,966	1.25	48,707
Black Marlin	1,852	1.25	2,315
Wahoo	16,822	1.50	25,234
Dogtooth Tuna	358	1.80	646
Swordfish	403	1.50	604
Sailfish	7,301	1.50	10,952
Subtotal other PPMUS	**102,583**	**1.40**	**143,852**
Barracudas	8,781	1.83	16,100
Sharks	7,898	1.11	8,798
Rainbow Runner	521	1.91	994
Moonfish (Opah)	2,671	1.00	2,671
Subtotal Misc.	**19,871**	**1.44**	**28,563**
Total Pelagics	**874,763**	**1.11**	**968,541**

Figure 1. American Samoa total annual landings: all pelagics, tuna and other PPMUS

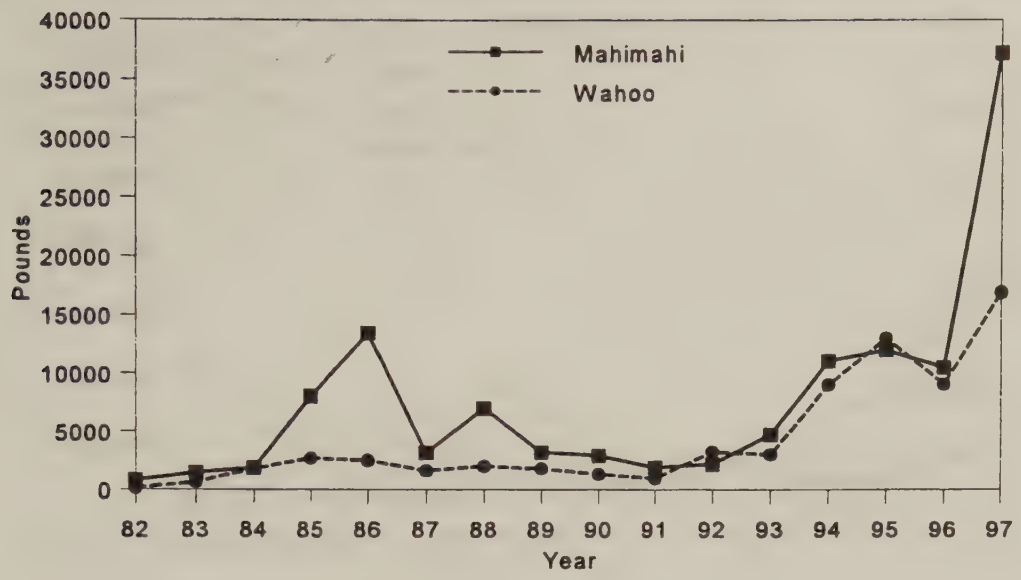


Interpretation: Estimated landings increased by 123% in 1997. Most of this increase is due to an increase in the longline fishery. Albacore landings increased dramatically due to increased longlining effort (Figure 4), bringing up the total pelagics landings.

Calculation: Estimated landings for tuna and other PPMUS were calculated by summing the total landings for the species in each category. Estimated landings for all pelagics represent the sum of tuna and other PPMUS plus landings from the miscellaneous category (see Table 1). These figures include both commercial and recreational/subsistence components of the fishery.

	Pounds Landed		
Year	**All Pelagics**	**Tuna**	**Other PPMUS**
1982	26,396	23,042	2,106
1983	96,318	90,057	4,806
1984	241,099	198,961	15,121
1985	143,212	107,656	19,686
1986	220,063	190,621	28,046
1987	155,324	142,155	12,798
1988	230,951	201,404	25,972
1989	195,563	166,922	24,253
1990	89,240	77,213	10,288
1991	95,009	78,033	15,129
1992	111,914	96,701	13,054
1993	67,037	46,757	18,498
1994	257,859	201,097	51,672
1995	372,179	300,844	65,050
1996	397,048	324,441	66,543
1997	883,923	757,691	116,554
Average	**223,946**	**187,725**	**30,599**

Figure 2. American Samoa annual landings: mahimahi and wahoo

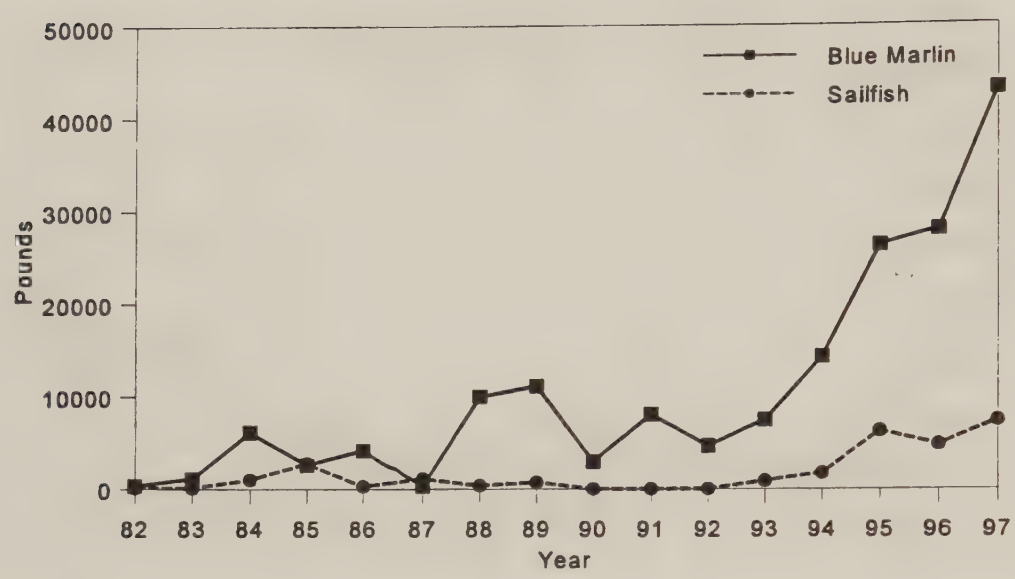


Interpretation: Mahimahi landings are variable across time, similar fluctuations occur in other WPACFIN regions. From 1984 - 1988 American Samoan fishermen exported mahimahi to Hawaii so landings were uniquely high. 1997 mahimahi landings are the largest since then, due to the increase in longlining -- longliners took in 89% of the mahimahi (Table 1). Wahoo landings have increased notably since 1994, the increase in 1997 is due to the increase in longlining trips -- longlining brought in 86% of the wahoo this year.

Calculation: Estimated landings for mahimahi and wahoo are summed for all fishing methods.

	Pounds Landed	
Year	**Mahimahi**	**Wahoo**
1982	777	114
1983	1,443	632
1984	1,844	1,777
1985	8,011	2,678
1986	13,435	2,492
1987	3,144	1,609
1988	6,976	1,981
1989	3,179	1,804
1990	2,913	1,320
1991	1,890	952
1992	2,174	3,244
1993	4,722	3,007
1994	11,048	9,000
1995	11,982	12,975
1996	10,464	9,040
1997	37,217	16,910
Average	**7,576**	**4,346**

Figure 3. American Samoa total annual landings: blue marlin and sailfish

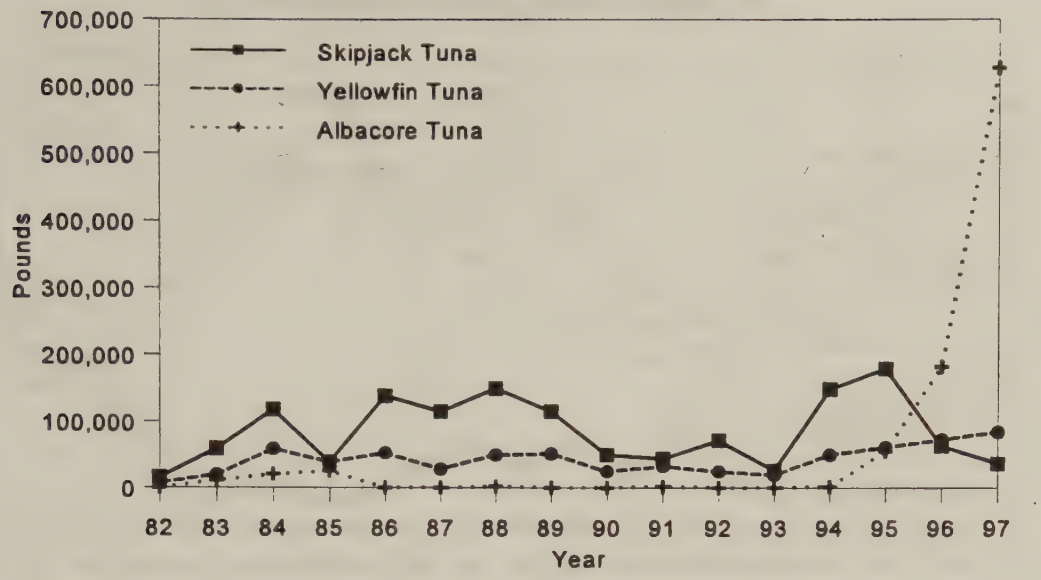


Interpretation: Increases in blue marlin landings for 1997 are probably due to increased longlining effort, as longlining took 85% of the marlin this year. Sailfish are caught more by longlining (56% in 1996 and 100% in 1997), which may explain the general increase in 1995-1997.

Calculation: The estimated total yearly landings of blue marlin and sailfish are summed for all fishing methods.

	Pounds Landed	
Year	**Blue Marlin**	**Sailfish**
1982	315	127
1983	1,083	74
1984	6,097	989
1985	2,574	2,744
1986	4,108	271
1987	297	1,081
1988	9,892	367
1989	11,047	687
1990	2,946	0
1991	8,012	0
1992	4,628	0
1993	7,404	873
1994	14,223	1,705
1995	26,268	6,184
1996	27,949	4,748
1997	**43,101**	**7,300**
Average	**10,622**	**1,697**

Figure 4. American Samoa total annual landings: skipjack, albacore and yellowfin tuna

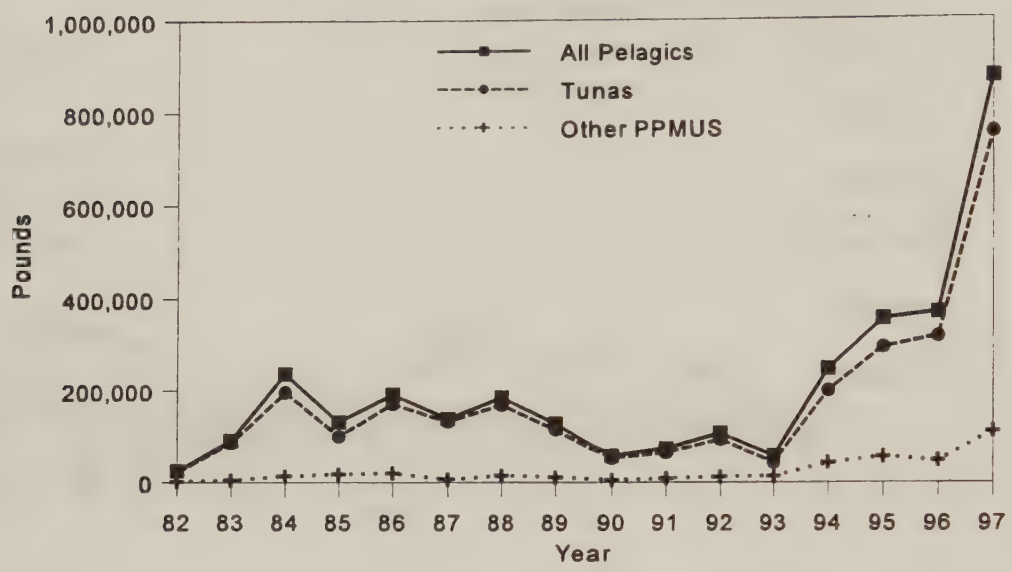


Interpretation: Dramatically increased albacore landings are due to the increase in longlining that began in 1995 and continued into 1997. Longlining took 100% of the albacore during 1995 and 1996 and 99.9% in 1997. Prior to that time, albacore was taken at low levels during occasional longlining trips. Decreases in skipjack landings are probably due to the decrease in troll fishing in 1997 -- 94% of the skipjack were taken by trollers (Table 1)and trolling trips have declined (Figure 7). Accordingly, the small increase of yellowfin tuna may be due to increase in longlining -- 69% of the yellowfin were taken by longliners this year.

Calculation: The estimated yearly total landings of skipjack, yellowfin and albacore tuna are summed for all fishing methods.

	Pounds Landed						
Year	**Skipjack**	**Yellowfin**	**Albacore**	**Year**	**Skipjack**	**Yellowfin**	**Albacore**
1984	117,693	58,704	20,390	1991	43,888	32,225	1,672
1985	38,902	38,586	24,821	1992	71,677	24,722	0
1986	138,064	52,464	0	1993	26,616	19,775	236
1987	114,381	27,627	0	1994	148,382	50,124	1,802
1988	149,416	49,159	1,884	1995	179,104	60,952	54,902
1989	114,805	51,383	0	1996	63,534	72,351	182,193
1990	49,613	24,565	0	**1997**	**36,779**	**84,147**	**627,581**
				Average	**85,483**	**42,101**	**57,218**

Figure 5. American Samoa annual commercial landings: all pelagic species, tunas and other PPMUS

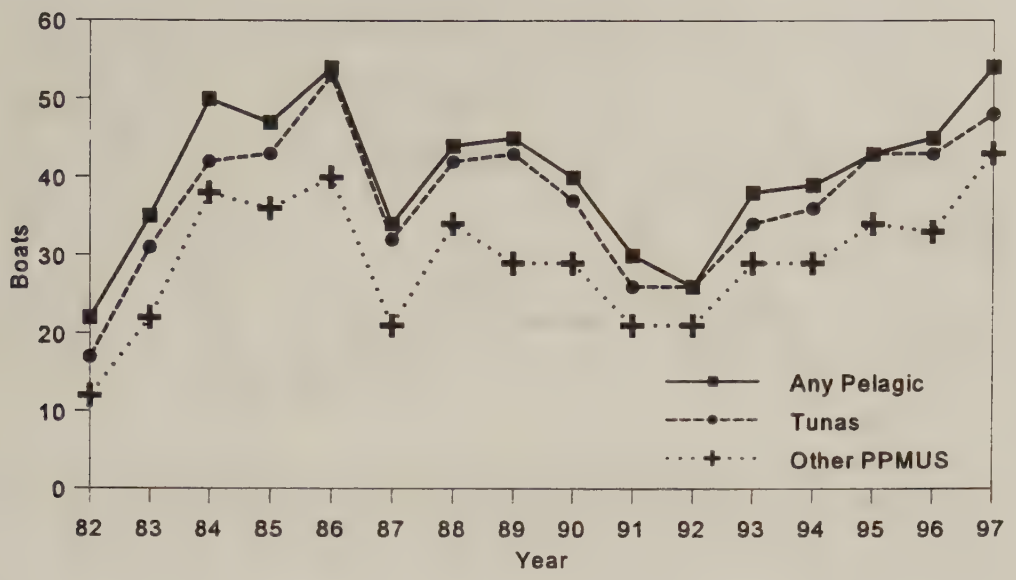


Interpretation: Commercial landings represent 99% of the landings for pelagic species in 1997, thus Figures 5 and 1 are virtually identical, as are the interpretations. Much of the increase in landings is due to an increase in the longline fishery in American Samoa.

Calculation: Estimated commercial landings for tunas and other PPMUS were calculated by summing commercial landings for the species in each category. Estimated landings for all pelagics represent the sum of tunas and other PPMUS plus landings for the miscellaneous category (see Table 1).

	Pounds Landed		
Year	**All Pelagics**	**Tunas**	**Other PPMUS**
1982	24,820	22,065	1,515
1983	90,744	85,069	4,441
1984	236,216	196,100	13,458
1985	131,310	99,987	17,515
1986	190,998	169,986	19,949
1987	137,925	131,457	6,305
1988	185,432	168,826	14,210
1989	127,560	113,904	10,745
1990	58,089	52,111	4,903
1991	73,044	63,607	8,096
1992	106,299	92,381	11,759
1993	57,184	42,573	12,945
1994	247,347	199,681	42,589
1995	355,305	293,571	55,826
1996	369,147	316,961	47,503
1997	874,763	754,981	110,481
Average	**204,136**	**175,204**	**23,890**

Figure 6. Number of American Samoa boats landing any pelagic species, tunas and other PPMUS

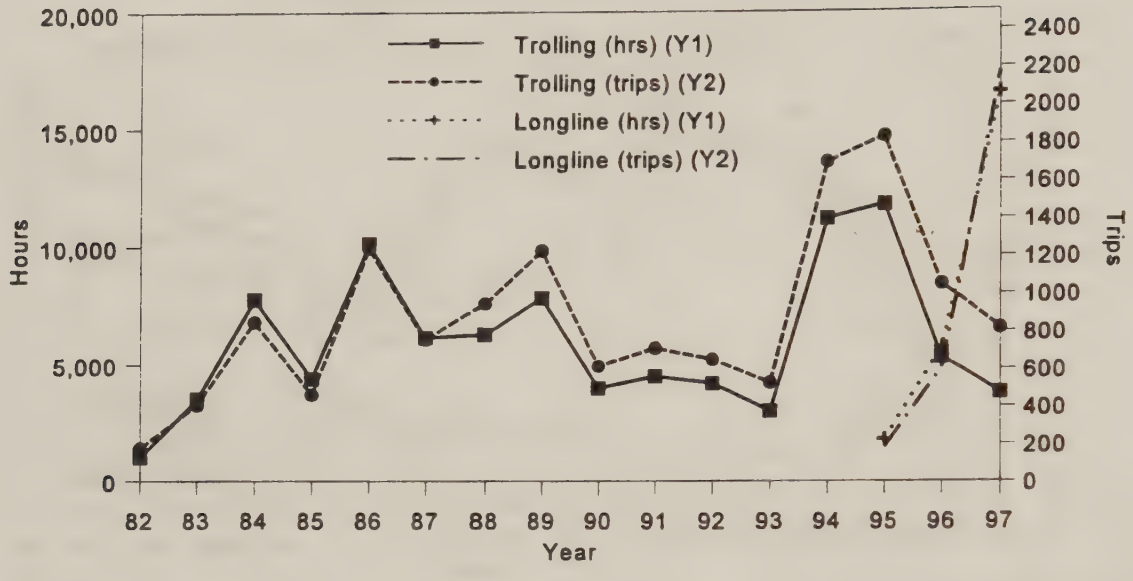


Interpretation: The number of boats participating in the pelagic fishery increased by 20% in 1996. Ten boats began longlining that year. In 1997, 22 boats used longline gear and 37 boats used trolling gear. As in past years, a small number of boats dominate the pelagic fishery, those boats being responsible for landing most of the pelagic catch.

Calculation: The sampling program is extensive enough, and the number of boats small enough, to use raw database counts of the number of vessels in a given year. Each boat counted here made at least one recorded landing of at least one pelagic species during a given year.

	Number of Boats landing:		
Year	**Any Pelagic**	**Tunas**	**Other PPMUS**
1982	22	17	12
1983	35	31	22
1984	50	42	38
1985	47	43	36
1986	54	53	40
1987	34	32	21
1988	44	42	34
1989	45	43	29
1990	40	37	29
1991	30	26	21
1992	26	26	21
1993	38	34	29
1994	39	36	29
1995	43	43	34
1996	45	43	33
1997	**54**	**48**	**43**
Average	**40**	**37**	**29**

Figure 7. American Samoa fishing effort for pelagic species



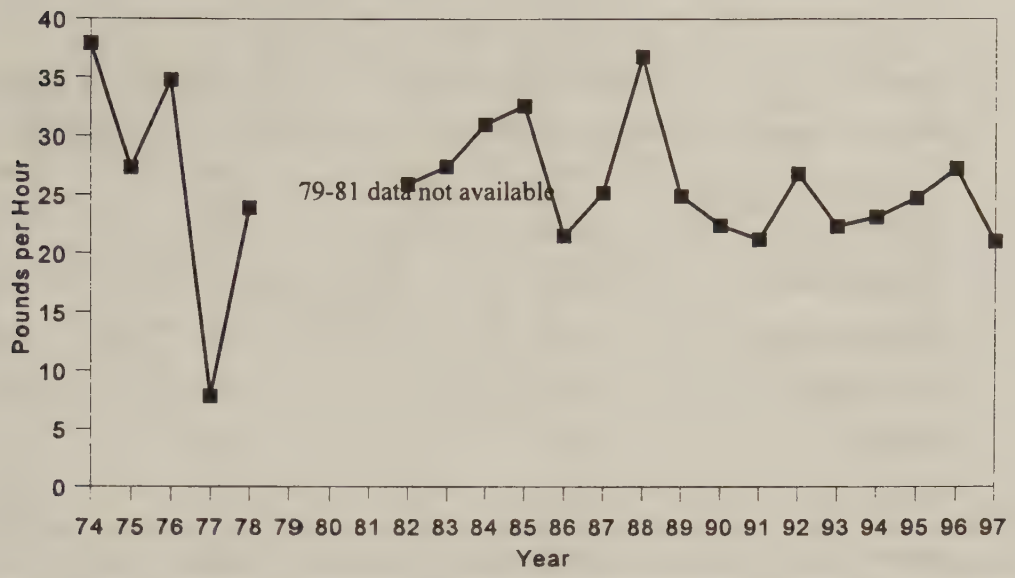
Interpretation: Fishing trips increased by 80% in 1997; effort is now split into longlining and trolling effort. Trolling effort decline is an effect of the switch-over by vessels to longline fishing. Trolling trips averaged 4.6 hours in length, shorter than in previous years, and longlining trips averaged 7.6 hours per trip.

Calculation: For 1982 to 1994 estimated total annual landings are used as a base for estimating trolling effort. The resultant number is divided by the average trolling catch per hour (CPUE) to give an estimate of the hours trolled. Trolling CPUE is calculated using only those trips where trolling was the only method used, and for which the number of hours was recorded. The number of trips is calculated by dividing the estimated total hours of effort by the average length of a trolling trip. For 1995, 1996 and 1997 total longline landings were subtracted from the total landings prior to using the above calculation, standardizing non-longline effort to trolling effort.

Estimated Fishing Effort

TROLLING			HOURS		TRIPS	
Year	Hours	Trips	Year	Trolling	Longline	Trolling	Longline
1982	1,019	177	1989	8,177		1,273	
1983	3,513	406	1990	4,103		631	
1984	7,785	853	1991	4,656		739	
1985	4,394	464	1992	4,178		650	
1986	10,240	1,259	1993	3,103		545	
1987	6,218	764	1994	11,453		1,738	
1988	6,421	978	1995	11,791	1,781	1,834	181
			1996	5,302	5,694	1,052	601
			1997	3,792	16,515	817	2,173
			Average	**6,009**	**7,997**	**886**	**985**

Figure 8. American Samoa overall pelagic catch per hour trolling



Interpretation: Total pelagic species CPUE is predominantly the combined skipjack and yellowfin CPUE shown in Figure 10, as these two species contributed 75% of the total troll catch. 1997 CPUE was lower than 1996 due to decreased CPUEs for most species caught by trolling (Figs. 9 and 10). Pelagic species CPUE has been variable, especially in the early years of the American Samoa troll fishery.

Calculation: For trips where trolling was used exclusively, and where effort was recorded, the total catch was divided by the total number of trolling hours to obtain CPUE. Data are from three sources; 1974-78 are from the Dory Project, 1982-84 are from the commercial catch monitoring system, and 1985-97 are from the creel survey program.

Year	lb../Hr	Trips	Year	Lb./Hr	Trips
1974	37.9	31	1987	25.2	215
1975	27.3	98	1988	36.8	276
1976	34.8	10	1989	24.9	359
1977	7.8	6	1990	22.4	280
1978	23.9	96	1991	21.2	203
1982	25.9	104	1992	26.8	204
1983	27.4	156	1993	22.3	213
1984	30.9	311	1994	23.1	379
1985	32.6	193	1995	24.7	460
1986	21.7	397	1996	27.2	357
			1997	21.0	298
			Average	**26.0**	**221**

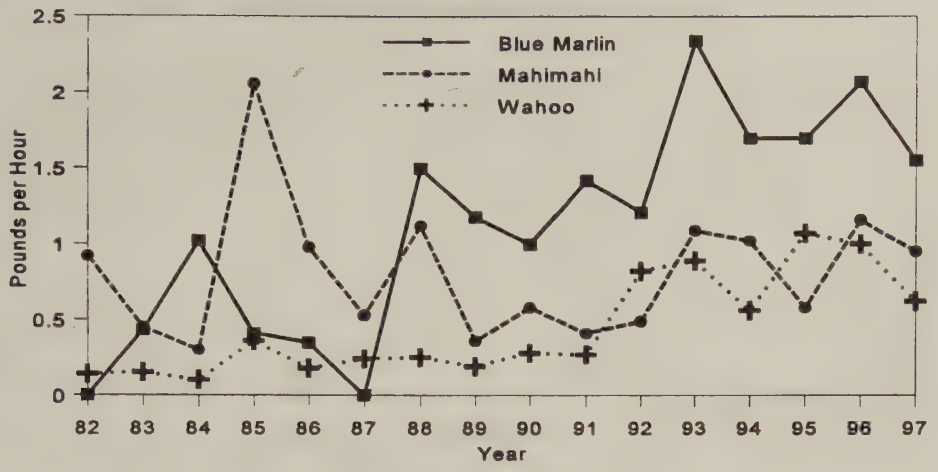
Table 3. American Samoa 1996 - 1997 estimated catch rates by species for the longline fishery.

Species	Number fish per 1,000 hooks		Average lbs. per fish	
	1996	1997	1996	1997
Albacore	30.91	31.18	40.0	43.9
Skipjack Tuna	0.30	0.60	9.6	8.4
Yellowfin Tuna	4.09	2.51	37.9	43.9
Bigeye Tuna	1.05	0.14	52.3	82.8
Mahimahi	1.25	2.81	26.3	25.6
Blue marlin	0.90	0.61	151.8	117.7
Wahoo	0.53	0.85	43.0	38.1
Sharks	0.40	0.18	109.4	98.9
Swordfish	0.03	0.01	150.0	100.0
Sailfish	0.20	0.22	88.4	69.0
Barracuda	0.58	0.29	13.5	15.4
Miscellaneous	0.10	0.03	61.8	59.8
Average	**3.36**	**3.29**		

The longline fishery in American Samoa is a newly emerging fishery since 1995. In 1995 four boats longlined in AS waters, 13 boats longlined in 1996 and in 1997 22 boats used this method. Catch rate comparisons of the American Samoa longline fishery in 1997 to the Hawaii longline fishery in 1996 show that albacore catch is much higher in American Samoa (31.2 fish per 1,000 hooks as compared to 4.1 fish per 1,000 hooks in Hawaii). From 1996 to 1997 in American Samoa there was not a great deal of change in catch rates or average sizes of fishes. There was, however, a notable decrease in yellowfin catch rate, but an increase in the average size, and for swordfish and blue marlin there was a decrease in both catch rate and average size. With only two years for comparisons, it is difficult to say if this is a result of natural variation or some other fishery-related factor. What is clear, however, is that the large increase in total catch cannot be attributed to an increase in CPUE, but to the increase in fishing effort.

Calculation: Total number of hooks set on the total number of sampling trips were summed then total number of fishes caught enumerated. Species CPUEs were taken from data collected during the sampling trips: the number of the species caught were divided by the number of hooks used to catch them and then multiplied by 1,000. Average pounds per species were calculated by dividing the number of total pounds of that species by the number of fish of that species caught.

Figure 9. American Samoa trolling catch rates: blue marlin, mahimahi and wahoo

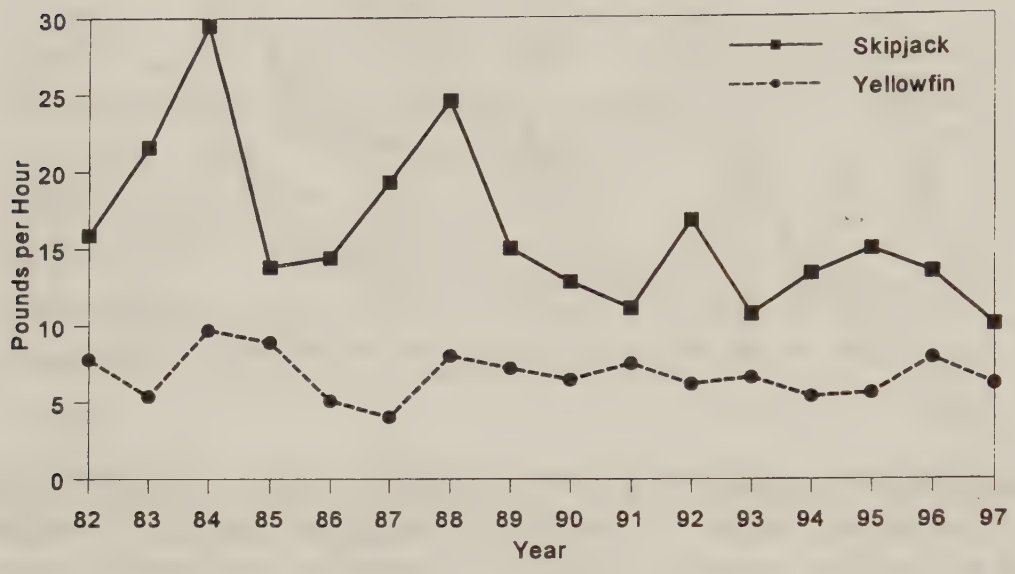


Interpretation: Blue marlin CPUE is variable but has increased over time. The variability is probably due to small number of fish taken, while the general increase in CPUE is probably due to gear and boat improvements. Mahimahi CPUE peaked in the mid eighties, when an export market existed for this species. Since that time, mahimahi CPUE has been variable, and without obvious trend. Wahoo CPUE has also increased over time, the reason for this increase is unknown. Although there was a decrease in CPUE for all species here, the values all remain above the 16-year average.

Calculation: For trips where trolling was used exclusively, and where effort was recorded, the total catch by species was divided by the total number of trolling hours to obtain CPUE.

	Pounds Caught per Hour Trolling		
Year	**Blue Marlin**	**Mahimahi**	**Wahoo**
1982	0.00	0.92	0.14
1983	0.43	0.45	0.15
1984	1.02	0.30	0.10
1985	0.41	2.06	0.36
1986	0.35	0.98	0.18
1987	0.00	0.53	0.24
1988	1.50	1.12	0.25
1989	1.18	0.36	0.19
1990	1.00	0.58	0.28
1991	1.42	0.41	0.27
1992	1.21	0.49	0.82
1993	2.34	1.09	0.89
1994	1.70	1.02	0.56
1995	1.70	0.58	1.07
1996	2.07	1.16	1.00
1997	1.55	0.95	0.62
Average	**1.12**	**0.81**	**0.4**

Figure 10. American Samoa trolling catch rates: skipjack and yellowfin tuna

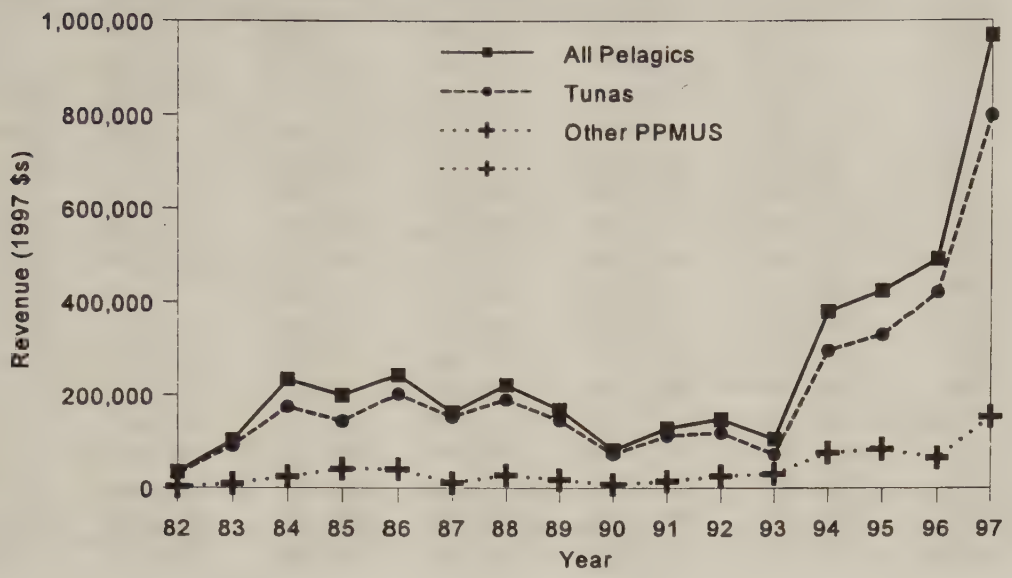


Interpretation: Skipjack CPUE has been highly variable through the years with a declining trend. This year it is well below the 16-year average. Yellowfin tuna CPUE has been fairly stable over time, and remains close to the average catch rate.

Calculation: For trips where trolling was used exclusively, and where effort was recorded, the total catch by species was divided by the total number of trolling hours to obtain CPUE.

	Pounds Caught Per Hour Trolling	
Year	**Skipjack**	**Yellowfin**
1982	15.9	7.8
1983	21.6	5.4
1984	29.5	9.7
1985	13.8	8.9
1986	14.4	5.1
1987	19.3	4.0
1988	24.6	8.0
1989	15.0	7.2
1990	12.8	6.5
1991	11.1	7.5
1992	16.8	6.2
1993	10.7	6.6
1994	13.0	5.4
1995	14.9	5.6
1996	13.4	7.9
1997	10.0	6.14
Average	**16.05**	**6.75**

Figure 11. American Samoa annual inflation-adjusted revenue for commercially landed pelagic species

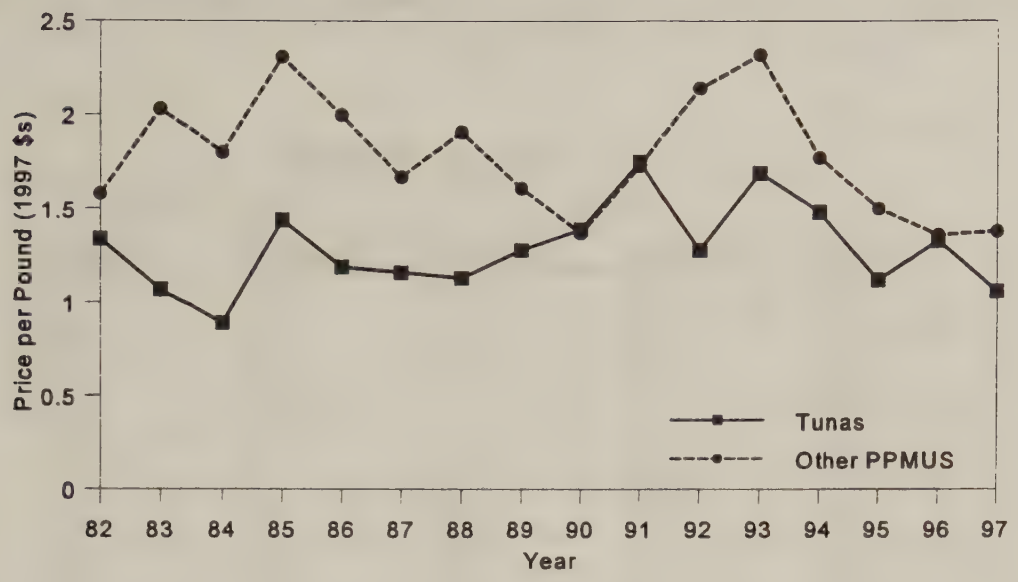


Interpretation: Revenues for commercial landings of all pelagic species doubled in 1997 from 1996. Striking increases in revenue from pelagic landings are due to coincident increases in catch which is due entirely to an increase in effort of longlining vessels. Fishermen actually received less per pound for tunas in 1997 than recent years (Figure 12), but because of the huge increase in catch, many more fish were sold than in previous years, thus revenues increased accordingly.

Calculation: Revenues from commercial landings for all pelagic species are adjusted for inflation by multiplying a given year's revenue by the quotient of the 1996 consumer price index (CPI) divided by the CPI for that year.

	Revenue ($)					
	All Pelagics		Tunas		Other PPMUS	
Year	Unadjust.	Adjusted	Unadjust.	Adjusted	Unadjust.	Adjusted
1982	21,824	34,045	18,990	29,624	1,534	2,393
1983	66,254	102,694	58,561	90,770	5,828	9,033
1984	153,571	233,428	114,981	174,771	15,938	24,226
1985	131,961	199,261	95,157	143,686	26,800	40,468
1986	166,851	243,602	138,498	202,207	27,311	39,874
1987	116,564	163,190	108,816	152,342	7,527	10,538
1988	163,189	221,936	139,902	190,267	19,940	27,118
1989	129,460	168,298	111,923	145,500	13,269	17,250
1990	66,865	80,906	59,747	72,294	5,554	6,721
1991	110,275	127,919	95,936	111,286	12,083	14,017
1992	132,899	147,518	106,260	117,948	22,629	25,118
1993	94,707	105,124	64,890	72,028	27,113	30,095
1994	348,401	379,758	271,170	295,575	68,993	75,202
1995	400,140	424,148	310,815	329,464	78,880	83,613
1996	482,491	492,141	412,170	420,414	63,246	64,511
1997	**968,541**	**968,541**	**798,797**	**798,797**	**152,650**	**152,650**
Average	**222,125**	**255,782**	**181,663**	**209,186**	**34,331**	**38,927**

Figure 12. American Samoa average inflation-adjusted price for tunas and other PPMUS

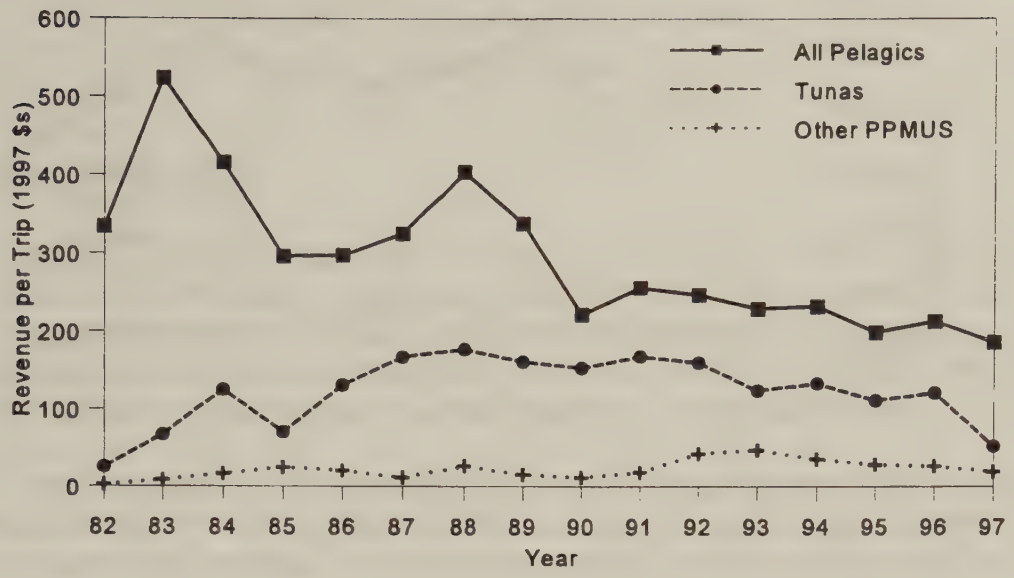


Interpretation: Prices for tuna decreased slightly in 1997. This overall decrease may be due to the lower price that the canneries pay per pound of tuna than the local stores and restaurants may pay. Prices in general for pelagic species remain low likely because of competition from frozen fish purchased from foreign longline vessels moored in Pago Harbor and from fishes imported from neighboring islands.

Calculation: The average price per pound for each year is calculated by dividing the estimated revenue by the estimated weight sold. The adjustment for inflation is made by multiplying the annual average price for a given year by the 1996 consumer price index (CPI) for American Samoa, and dividing by the CPI for the given year.

	Average Price ($/lb)			
	Tunas		Other PPMUS	
Year	Unadjust.	Adjusted	Unadjust.	Adjusted
1982	0.86	1.34	1.01	1.58
1983	0.69	1.07	1.31	2.03
1984	0.59	0.89	1.18	1.80
1985	0.95	1.44	1.53	2.31
1986	0.81	1.19	1.37	2.00
1987	0.83	1.16	1.19	1.67
1988	0.83	1.13	1.40	1.91
1989	0.98	1.28	1.23	1.61
1990	1.15	1.39	1.13	1.37
1991	1.51	1.75	1.49	1.73
1992	1.15	1.28	1.92	2.14
1993	1.52	1.69	2.09	2.32
1994	1.36	1.48	1.62	1.77
1995	1.06	1.12	1.41	1.50
1996	1.30	1.33	1.33	1.36
1997	1.06	1.06	1.38	1.38
Average	**1.04**	**1.29**	**1.41**	**1.78**

Figure 13. American Samoa average inflation-adjusted revenue per trip landing PPMUS for non-longline vessels

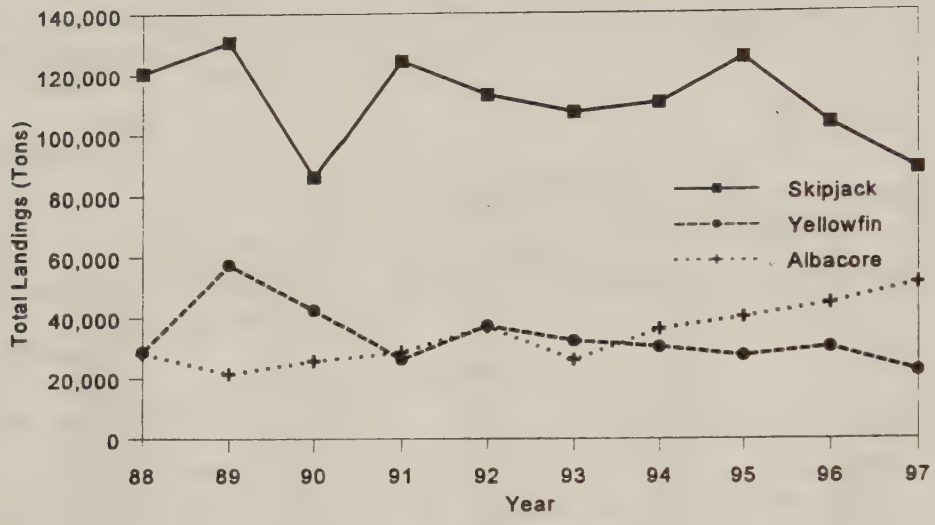


Interpretation: Revenue per trip decreased slightly in 1997 and remains relatively low. This may be due to the overall decrease in CPUE for most species caught by trolling vessels.

Calculation: For commercial trips where pelagic species were landed, the average revenue per trip was calculated for each category. Revenue was adjusted for inflation by multiplying it by the quotient of the 1997 CPI divided by the respective years' CPI.

	Revenue per trip ($)					
	All Pelagics		Tunas		Other PPMUS	
Year	Unadjust.	Adjusted	Unadjust.	Adjusted	Unadjust.	Adjusted
1982	214	334	16	25	1	2
1983	338	524	43	67	5	8
1984	274	416	82	125	11	16
1985	196	296	47	70	16	24
1986	203	297	90	131	14	20
1987	232	325	119	167	8	11
1988	297	404	130	177	19	26
1989	260	338	124	161	12	15
1990	184	222	126	153	9	11
1991	221	256	145	168	15	18
1992	223	247	144	160	38	42
1993	206	229	111	124	42	47
1994	212	232	122	133	32	35
1995	187	199	105	111	27	28
1996	213	217	119	121	26	26
1997	186	186	52	52	19	19
Average	**228**	**295**	**98**	**122**	**18**	**22**

Figure 14. Total cannery landings for skipjack, yellowfin and albacore tuna



Interpretation: The quantity of fish landed at American Samoa's canneries exceeds local landings by a factor of a thousand. Though some locally caught pelagics, especially albacore, are sold to the canneries, the vast majority of the fish landed have been taken in distant water fisheries. Cannery landings have remained essentially stable for the last several years, though albacore landings have increased across time and skipjack landings have decreased.

Calculation: Cannery landings are from monthly landings summaries supplied by the canneries.

	Short Tons landed		
Year	**Skipjack**	**Yellowfin**	**Albacore**
1988	120,500	28,800	28,200
1989	130,800	57,500	21,400
1990	86,300	42,600	25,700
1991	124,400	26,200	28,500
1992	113,200	37,200	36,900
1993	107,400	32,200	26,000
1994	110,500	30,100	36,000
1995	125,300	27,300	40,000
1996	103,600	30,000	44,500
1997	**88,400**	**22,700**	**50,900**
Average	**111,040**	**33,460**	**33,810**

Appendix 2

Territory of Guam

Introduction and Summary

Pelagic fishing vessels based on Guam fall into two broad categories: 1) distant -water purse seiners and longliners that fish primarily outside the EEZ and transship through Guam and 2) small primarily recreational trolling boats that are either towed to launch sites or berthed in the marinas and fish only local waters, either within the EEZ or occasionally in the adjacent EEZ of the Northern Mariana Islands. This report covers primarily the local small-boat pelagic fishery.

Since 1981, the estimated number of vessels participating in the fishery has steadily increased from 119 in 1980 to 482 in 1996. The number of boats in the fishery decreased slightly between 1996 and 1997. Most vessels are less than 10 m (33 feet) in length and are typically owner-operated by persons who earn a living outside of fishing. However, most trollers sell a portion of their catch at one time or another, and it is impossible to make a distinction between recreational, subsistence, or commercial fishers. A small, but significant, segment of the pelagic fleet consists of marina-berthed charter vessels that are operated primarily by full-time captains and crews.

Estimated annual landings have varied widely, ranging between 175 and 433 tons. Landings in 1997 consisted almost entirely of five major species: mahimahi (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), and Pacific blue marlin (*Makaira mazara*). Minor components include rainbow runner (*Elagatis bipinnulatus*), great barracuda (*Sphyraena barracuda*), kawakawa (*Euthynnus affinis*), and dogtooth tuna (*Gymnosarda unicolor*). Approximately a dozen additional species are landed incidentally each year. During 1997, sailfish (*Istiophorus platypterus*) and the shortbill spearfish (*Tetrapterus angustirostris*) were not encountered during offshore creel surveys. A small portion of the pelagic catch, "Assorted troll fish," consists of estimated troll catch weights when a species breakdown could not be obtained.

There are wide year to year fluctuations in the mahimahi, wahoo, marlin, and tuna landings. Yellowfin tuna landings appear to have declined from 1982 to 1989, spiked in 1992, then declined until 1996. Yellowfin landings decreased slightly during 1997. Annual landings of blue marlin increased from 1980, peaking in 1990. Marlin landings decreased sharply in 1996, the lowest since 1986, but increased in 1997.

Aggregate landings of non-tuna PPMUS and all pelagics fluctuate greatly, but appear to be increasing, while those of the tunas show no general trend. In the early 1980s the bulk of the catch

consisted of tunas, but since 1985 it has consisted of non-tuna or "other" PPMUS, with mahimahi usually the most important species. Commercial landings of all pelagics also show a similar trend.

Effort in terms of total hours fished and total trolling trips decreased slightly, but with trip length increasing. This may reflect the increase in the number of bad weather days and unfishable days, and a decrease in the number of charter trips due to a drop in tourism during the last quarter of 1997. Compared with 1996, charter fishing trips decreased from 16 trips a day to 13, while non-charter boats decreased from 28 to 26 trips a day. Charter boats made up less than 10% of the pelagic fleet, but accounted for 33% of trolling trips, 22% of the pelagic catch, and 24% of trolling hours.

Annual trolling catch rates have vary widely for all pelagic species. Trolling catch rates increased for blue marlin, increased slightly for skipjack tuna, decreased for mahimahi and wahoo, and remained the same for yellowfin tuna. CPUE for non-charter trolling boats was slightly higher for charter boats, 12.7 pounds per hou,r compared with 11.2 pounds per hour for charter boats.

Inflation-adjusted prices increased from 1996, especially with non-tuna PPMUS. There is still a difficulty in obtaining a consistent supply of fresh fish from local fishermen, although fish vendors have been providing fishermen with a consistent market for their fish, increasing commercial landings. Inexpensive foreign-caught fish marketed locally without being "value-added" is still a concern among local fishermen. The Department of Commerce estimates that approximately 5% of "rejected" fish from longliners enters the local economy.

Beginning in 1997, shark fin data has been collected by the Department of Customs and Quarantine. Approximately 21,820 pounds of dried shark fin has been reported to have been shipped out of Guam, destined for markets in Hong Kong.

DAWR is currently developing and completing a new expansion system with the assnstance of NMFS. The program, which will automate the expansion process, is currently being completed. The expansion algorithms for catch and effort are currently being reviewed and revised for all strata covered by the offshore creel survey.

Recommendations

1. The status and ongoing usefulness of the Guam consumer price index for time-series inflation-adjustment should be reviewed. Since the consumer price index base year has been changed, knowing how to adjust for previous years should be examined.

2. The Guam Offshore Expansion system is being developed with the assistance of NMFS. DAWR's historical offshore data should be incorporated into the new system to obtain a historical look at the growth and evolution of the local pelagic fishery.

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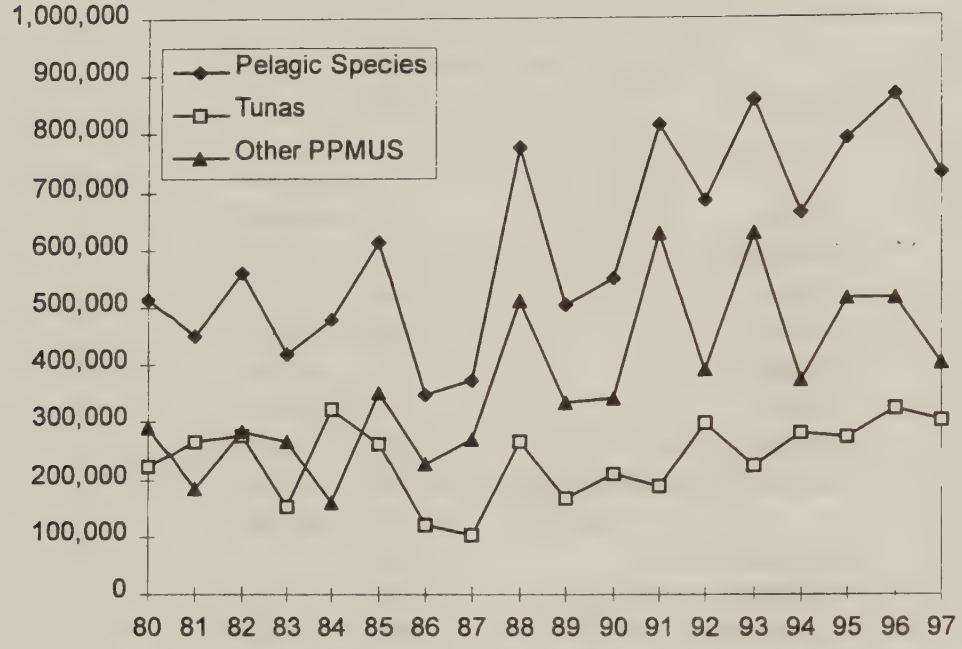
TABLE 1. Guam 1997 creel survey - pelagic species composition.

Species	Pounds Landed
Sharks	5,238
Mahimahi	242,666
Wahoo	87,469
Blue Marlin	87,382
Striped Marlin	0
Sailfish	0
Spearfish	0
Dogtooth Tuna	1,858
Double-lined mackerel	37
Subtotal PPMUS	**424,650**
Skipjack Tuna	206,570
Yellowfin Tuna	92,571
Bigeye Tuna	0
Kawakawa	3,256
Tunas (misc.)	0
Subtotal Tunas	**302,397**
Rainbow Runner	4,582
Barracudas	2,802
Other	159
Subtotal Misc.	8,799
Assorted Troll Fish	16,448
Total Pelagics	**751,038**

TABLE 2. Guam 1997 annual commercial average price of pelagic species.

Species	Average Price ($/lb.)
Sharks	1.41
Mahimahi	1.85
Wahoo	2.25
Marlin	1.17
Spearfish	1.30
Sailfish	1.38
Dogtooth Tuna	1.65
Average Other PPMUS	1.76
Skipjack Tuna	1.31
Yellowfin Tuna	2.14
Kawakawa	1.37
Average Tunas	**1.65**
Troll fish	
Rainbow Runner	1.99
Barracuda	1.88
Average All Pelagics	**1.71**

Figure 1. Guam annual estimated total landings: all pelagics, other PPMUS, and tunas.



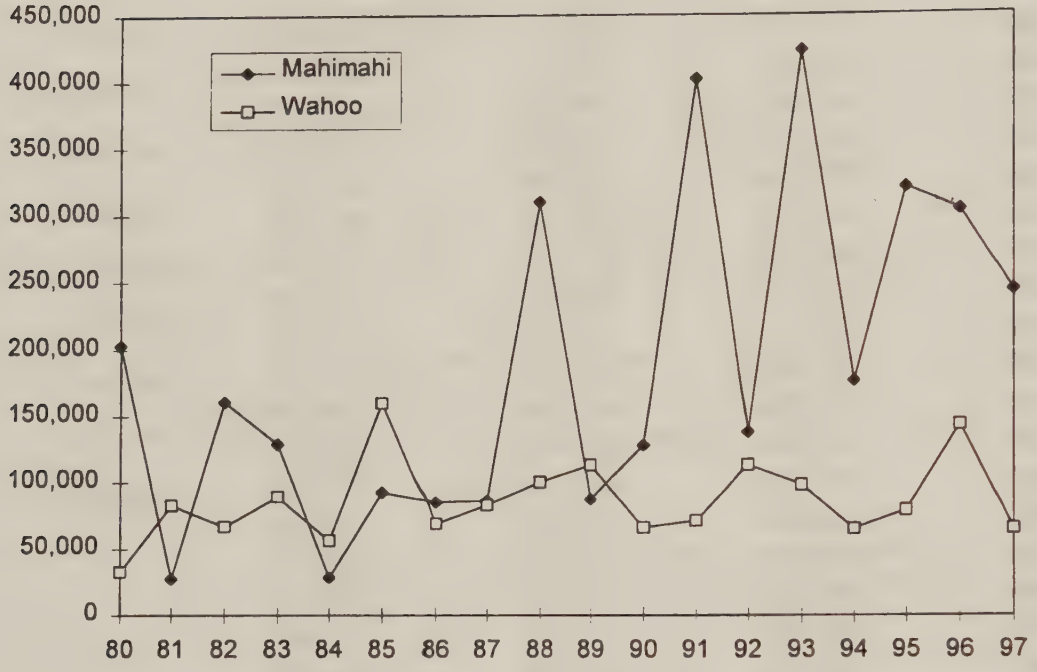
Interpretation: In the early 1980's the bulk of the pelagic catch tended to consist of tunas. Between 1985 and 1997, the total pelagic catch consisted primarily of non-tuna PPMUS due to an interest in targeting blue marlin, increasing landings of mahimahi, and a lack of interest in skipjack tuna. In 1997, pelagic landings decreased 16%, non-tuna PPMUS decreases 41%, and tuna landings decreased 6%. Charter trolling trips accounted for 22% of the overall pelagic catch.

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program, expanded with the assistance of NMFS.

Calculation: A 362 day (363 days during leap years) expansion is run for each calendar year of survey data to produce catch and effort estimates for each fishing method surveyed. Percent species composition is calculated by weight for the sampled catch for each method to produce catch estimates for each species for the expanded period. The annual catch for all pelagic species and the PMUS separately are summed across all methods to obtain the numbers plotted above except for 1992 which includes only the trolling method.

Year	Pounds Landed All Pelagics	Other PPMUS	Tunas
1980	515,631	290,703	224,928
1981	450,813	183,549	267,264
1982	560,046	284,195	275,851
1983	418,222	267,117	151,106
1984	479,134	321,143	157,991
1985	614,520	352,649	261,872
1986	347,673	227,130	120,543
1987	370,586	268,068	102,519
1988	776,336	510,551	265,785
1989	501,880	334,857	167,024
1990	549,944	341,785	208,159
1991	814,786	627,398	187,388
1992	685,513	388,634	296,833
1993	858,944	626,907	224,656
1994	663,476	372,541	279,657
1995	791,176	514,391	271,505
1996	865,967	512,925	322,657
1997	**729,296**	**302,398**	**401,651**
Average	**610,775**	**236,183**	**370,169**
Std Deviation	**168,872**	**67,151**	**139,689**

Figure 2. Guam annual estimated total landings: mahimahi and wahoo.



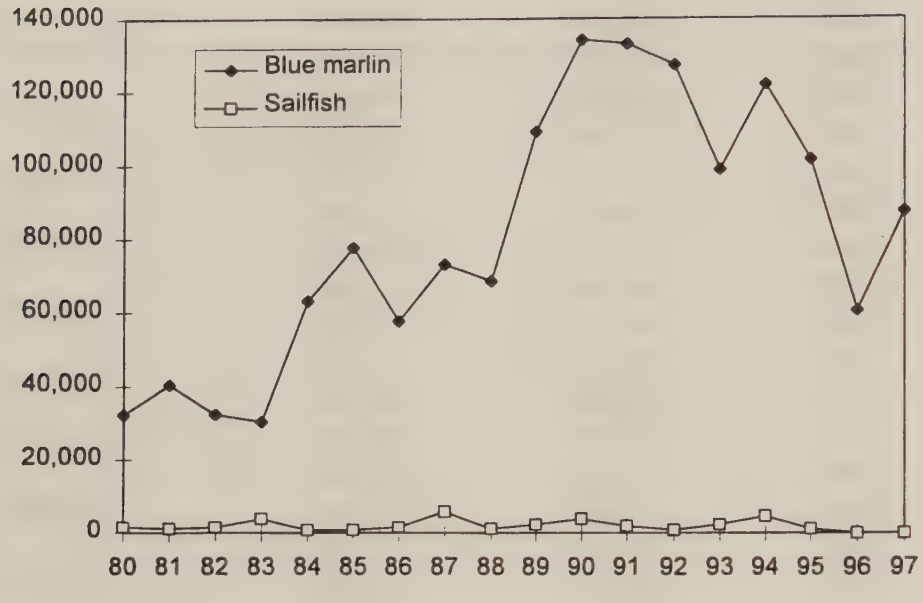
Interpretation: Landings of mahimahi and wahoo decreased significantly, 20% and 55% respectively, between 1996 and 1997. However, mahimahi still remained the most important pelagic species in Guam's small boat fishery. Both species still show a pattern of long-term extreme fluctuations, especially mahimahi. Virtually all landings are by the trolling method.

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files, expanded with the assistance of NMFS.

Calculation: Totals by species are summed across all fishing methods for all years except 1992-93 as described in figure 1.

Year	Pounds Landed Mahimahi	Wahoo
1980	203,136	32,825
1981	27,954	82,635
1982	160,200	66,416
1983	128,130	89,010
1984	28,847	56,501
1985	92,407	159,300
1986	85,393	68,830
1987	86,362	82,892
1988	310,032	99,801
1989	87,158	111,977
1990	126,968	66,107
1991	402,107	71,001
1992	136,421	112,872
1993	423,988	97,448
1994	175,183	64,595
1995	321,014	78,530
1996	303,957	142,062
1997	**242,666**	**64,469**
Average	**185,662**	**85,959**
Std Deviation	**121,921**	**30,907**

Figure 3. Guam annual estimated total landings: blue marlin and sailfish.



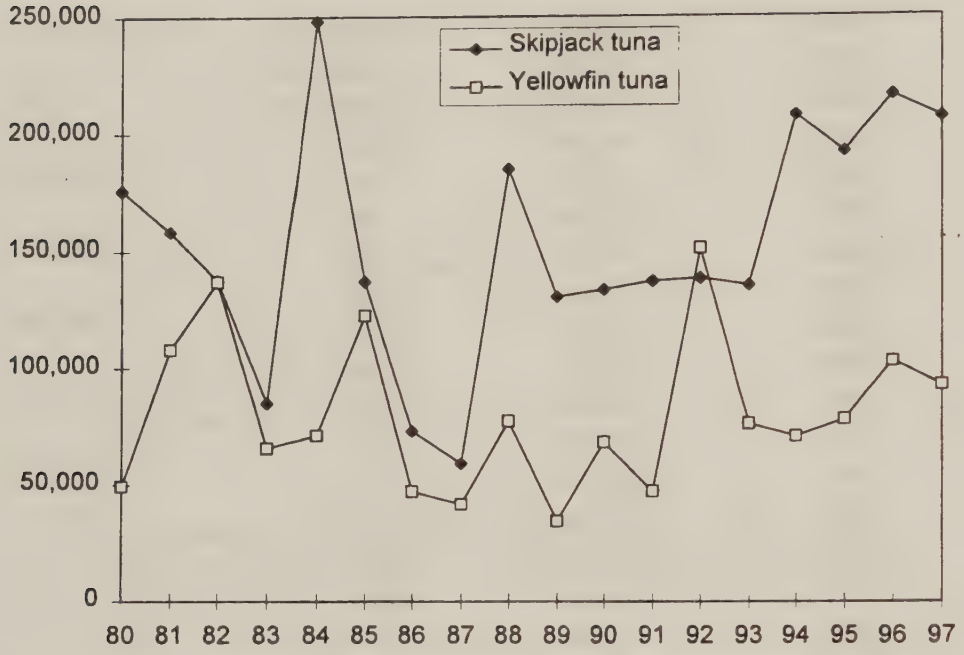
Interpretations: Landings of blue marlin increased 44% between 1996 and 1997, the only pelagic species that had an increase in 1997. The rapid increase in marlin landings between 1987 and 1989 may have been due to increase targeting of this specie during the marlin season, expecially charter boats, but marlin landings have generally decreased since then. Sailfish were not encountered during offshore creel surveys during 1996 and 1997. All landings of blue marlin were by the trolling method.

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files, expanded with the assistance of NMFS.

Calculation: Totals by species are summed across all fishing methods for all years except 1992-93 as described in figure 1.

Year	Pounds Landed Blue Marlin	Sailfish
1980	32,192	1,411
1981	40,389	1,272
1982	32,465	1,425
1983	30,359	3,820
1984	63,057	952
1985	77,565	915
1986	57,682	1,474
1987	73,169	5,913
1988	68,511	1,145
1989	109,241	2,191
1990	136,541	3,730
1991	129,992	2,000
1992	127,356	745
1993	98,698	2,379
1994	121,844	4,482
1995	101,359	1,242
1996	60,500	0
1997	**87,382**	**0**
Average	**80,500**	**1,953**
Std Deviation	**35,465**	**1,586**

Figure 4. Guam annual estimated total landings: skipjack and yellowfin tunas.



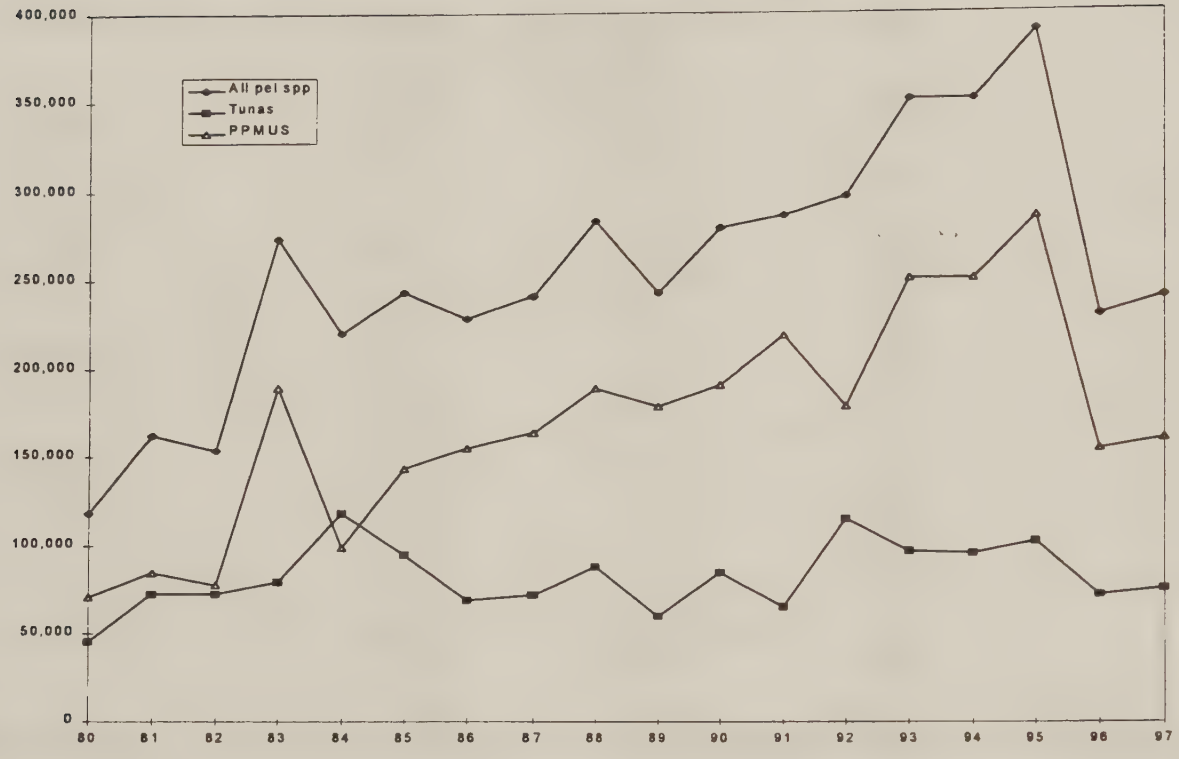
Interpretations: Landings of skipjack tuna and yellowfin decreased 4% and 10% respectively between 1996 and 1997. Landings of skipjack tuna exceeded those of all other species in five of the last 16 years, and were exceeded by mahimahi in all but two of the remaining years. With the exception of 1992, landings of skipjack tuna have always exceeded those of yellowfin tuna, often by a 2:1 or better margin. Given the relative unmarketablility of skipjack tuna in the local market, and the desirability of yellowfin tuna, the availability of skipjack tuna probably exceeds that of yellowfin tuna by a wider margin than this chart would indicate. Virtually all landings are by the trolling method.

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files, expanded with the assistance of NMFS.

Calculation: Totals by species are summed across all fishing methods for all years except 1992-93 as described in figure 1.

Year	Pounds Landed Skipjack tuna	Yellowfin tuna
1980	175,542	49,386
1981	158,493	107,828
1982	137,735	137,202
1983	85,008	65,598
1984	248,243	71,502
1985	137,097	122,707
1986	73,199	47,290
1987	59,228	41,754
1988	184,838	77,434
1989	130,682	34,404
1990	133,460	68,076
1991	137,136	47,398
1992	138,547	151,025
1993	135,163	76,285
1994	207,713	70,902
1995	192,218	78,021
1996	215,944	102,670
1997	206,570	92,571
Average	153,156	80,114
Std Deviation	50,825	33,190

Figure 5. Guam annual estimated commercial landings: all pelagics, tunas, and other PPMUS.



Interpretations: Commercial pelagic fishery landings appear to have increased steadily for the last 15 years, especially with the growth of the charter boat industry. A drop in 1996 may have been due to a major fish vendor going out of business during 1995, and from fishermen marketing their fish elsewhere than the Fishermen's Coop, a major receipt book vendor. Other fish vendors have also opened up in 1995 that competed with established vendors and are in the process of being brought into the commercial receipt book program. In 1997, the commercial landings increased slightly, approximately 5%.

Source: The WPacFIN-sponsored commercial landings system.

Calculation: The total estimated commercial landings for each year were calculated by summing the weight fields in the commercial landings data base from the principle fish wholesalers on Guam, and then multiplying by an estimated percent coverage expansion factor. The annual expansion factor was subjectively created based on as much information as possible depending on the year, including: an analysis of the "disposition of catch" data available from the DAWR offshore creel survey; an evaluation of the fishermen in the fishery and their entry/exit patterns; general "dock side"knowledge of the fishery and the status of the marketing conditions and structure; and the number of records in the data base; and a certain measure of best guesses.

Year	Pounds Landed All Pelagic Species	Tunas	Other PPMUS
1980	118,275	45,043	70,319
1981	162,186	72,229	84,371
1982	153,577	72,347	77,602
1983	273,120	79,313	189,241
1984	220,074	118,167	98,412
1985	243,060	94,691	143,509
1986	227,928	68,510	154,749
1987	240,790	71,711	163,449
1988	283,264	87,962	188,498
1989	242,554	59,825	178,424
1990	279,121	84,176	190,201
1991	285,696	64,694	218,588
1992	296,809	114,765	178,307
1993	351,201	96,289	250,211
1994	351,187	95,321	250,348
1995	230,585	60,403	170,182
1996	229,908	71,528	154,184
1997	**240,365**	**75,060**	**160,097**
Average	**254,942**	**81,882**	**168,666**
Std Deviation	**69,443**	**19,055**	**60,425**

Figure 6. Guam estimated number of trolling boats.

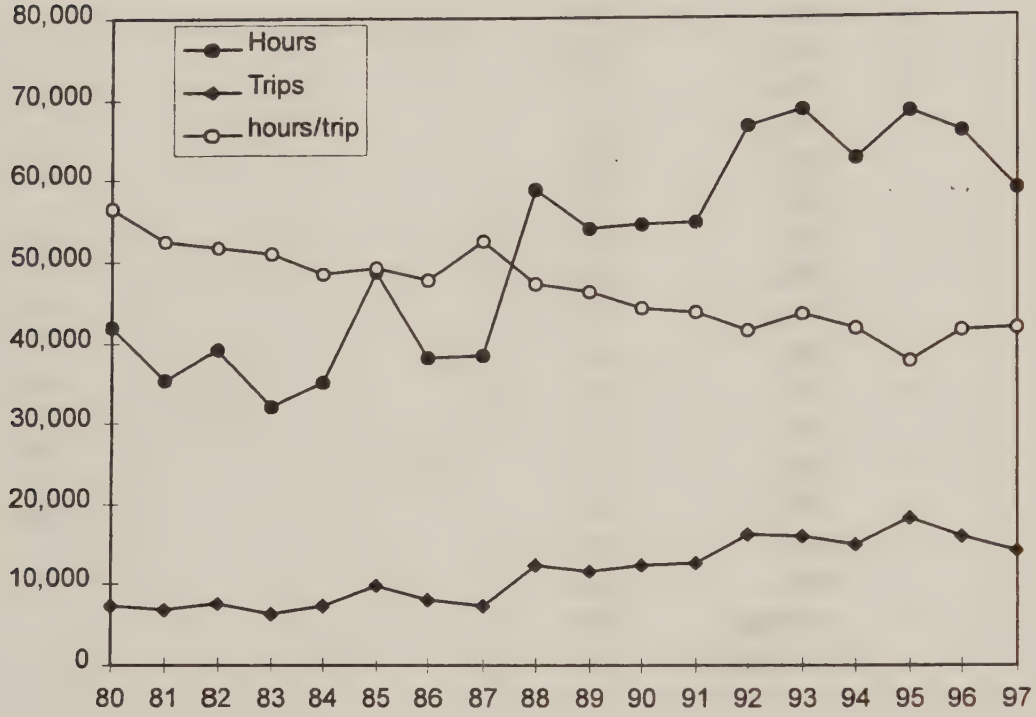
Interpretation: The number of trolling boats decreased slightly between 1996 and 1997, decreasing 4%, reversing a trend of general increase in the number of trolling boats since 1980. A significant number of unfishable and "bad weather" days during the last quarter of 1997 may have attributed to this decrease. The number of charter boats has remained fairly constant for the past two years.

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files, expanded with the assistance of NMFS.

Calculation: Since only a fraction of the days of the year are actually sampled, it is not possible to know the exact number of boats participating in the fishery. The trolling boat log of 1997 was converted and processed through a boat estimator model by NMFS 1000 times. There were 1378 logged trolling trips made by 353 different vessels, counted on 87 sample days.

Year	Number of Boats
1980	119
1981	109
1982	196
1983	238
1984	161
1985	199
1986	182
1987	183
1988	243
1989	270
1990	262
1991	245
1992	271
1993	296
1994	328
1995	436
1996	482
1997	**464**
Average	**260**
Std Deviation	**109**

Figure 7. Guam annual estimated pelagic species trips, hours, and hours per trip for trolling.



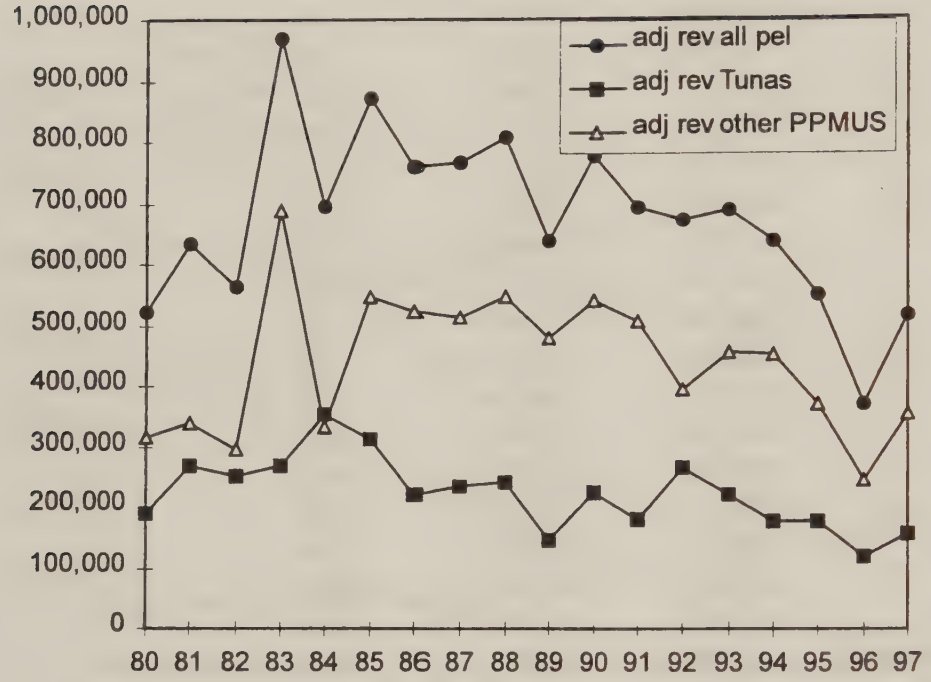
Interpretations: The number of hours and trips decreased 11% and 12% respectively, between 1996 and 1997, while hours per trip increased 17%. This could have been due to the number of unfishable days the last quarter of 1997, and a decrease in charter trips due to a significant drop in tourism. Charter trolling trips still accounted for 34% of all trolling trips and 24% of hours spent trolling.

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files, expanded with the assistance of NMFS.

Calculation: The data expansion system is run on a calendar year's worth of survey data to produce catch and effort estimates for each fishing method surveyed. These plots are of the estimated boat hours spend fishing and number of trips for the trolling method as taken directly from creel survey expansion system printouts.

Year	Hours	Trips	Hours per Trip
1980	41,870	7,394	5.7
1981	35,430	6,763	5.2
1982	39,146	7,566	5.2
1983	32,085	6,287	5.1
1984	35,196	7,276	4.8
1985	48,823	9,900	4.9
1986	38,201	7,992	4.8
1987	38,475	7,342	5.2
1988	58,874	12,454	4.7
1989	54,119	11,725	4.6
1990	54,486	12,340	4.4
1991	54,686	12,523	4.4
1992	66,535	16,076	4.1
1993	68,609	15,810	4.3
1994	62,616	15,003	4.2
1995	68,285	18,214	3.8
1996	65,952	15,936	3.6
1997	**58,881**	**14,104**	**4.2**
Average	**51,237**	**11,373**	**4.6**
Std Deviation	**12,757**	**3,893**	**0.5**

Figure 8. Guam annual estimated commercial inflation-adjusted total revenues: all pelagics, tunas,and other PPMUS.



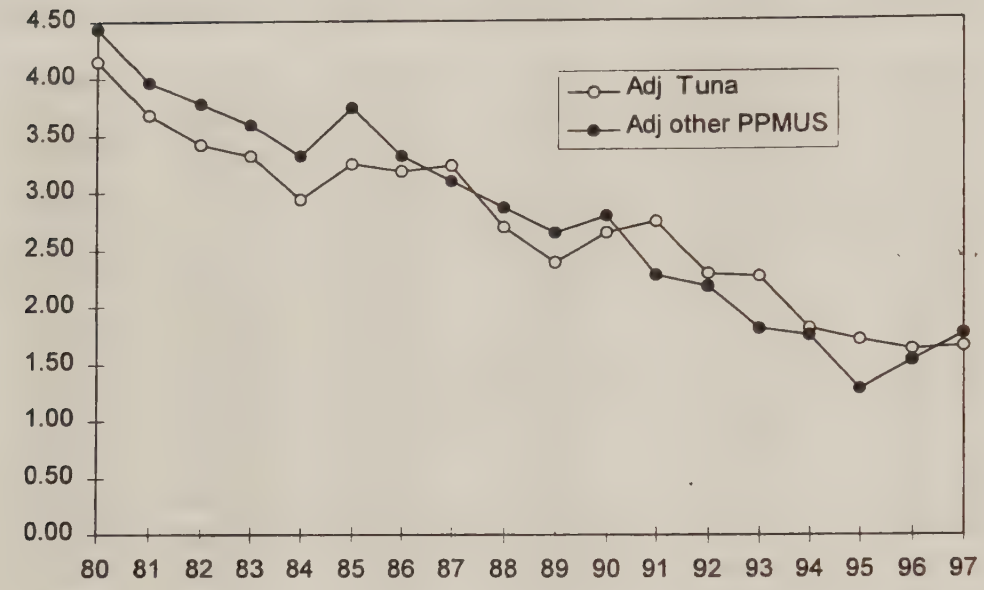
Interpretations: Adjusted revenues for all pelagic species and other PPMUS increased significantly between 1996 and 1997, 39% for all pelagics, 29% tunas, and 45% for other PPMUS. This mirrors the increase in commercial landings observed in 1997. This may be due in part to the major fish vendors competing for fish caught by fishermen, and better marketing of that fish.

Source: The WPACFIN-sponsored commercial landings system.

Calculation: The total estimated revenue for each year was calculated by summing the revenue fields in the commercial landings data base from the principle fish wholesalers on Guam, and then multiplying by the same percent coverage expansion factor as were the landings in figure 5. Inflation-adjusted total revenue per trip is derived from the Guam annual Consumer Price Index (CPI).

	Revenues ($)					
	All Pelagics		Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
1980	149,160	520,717	54,353	189,745	90,623	316,365
1981	218,384	638,878	92,914	269,266	117,052	339,218
1982	203,847	562,007	90,719	250,112	107,573	296,579
1983	364,527	971,100	100,029	266,478	258,501	688,646
1984	283,724	695,124	143,598	351,815	135,498	331,970
1985	369,651	872,006	131,953	311,278	230,855	544,588
1986	330,302	758,704	96,395	221,419	226,935	521,269
1987	347,753	764,710	107,055	235,413	233,116	512,622
1988	386,468	807,719	114,981	240,311	261,901	547,373
1989	337,586	636,349	76,865	144,891	253,932	478,661
1990	471,241	777,548	136,321	224,929	325,372	536,863
1991	462,191	691,899	119,640	179,101	337,328	504,980
1992	492,707	669,589	195,547	265,748	289,129	392,926
1993	547,835	686,986	175,360	219,902	362,728	454,860
1994	593,838	637,189	165,296	177,362	418,612	449,171
1995	537,889	548,109	173,629	176,928	361,363	368,229
1996	366,280	370,675	118,883	120,310	239,901	242,780
1997	**515,007**	**515,007**	**154,819**	**154,819**	**351,229**	**351,229**
Average		**673,240**		**222,213**		**437,741**
Std Deviation		**142,676**		**59,395**		**114,662**

Figure 9. Guam average price of tunas and other PPMUS.



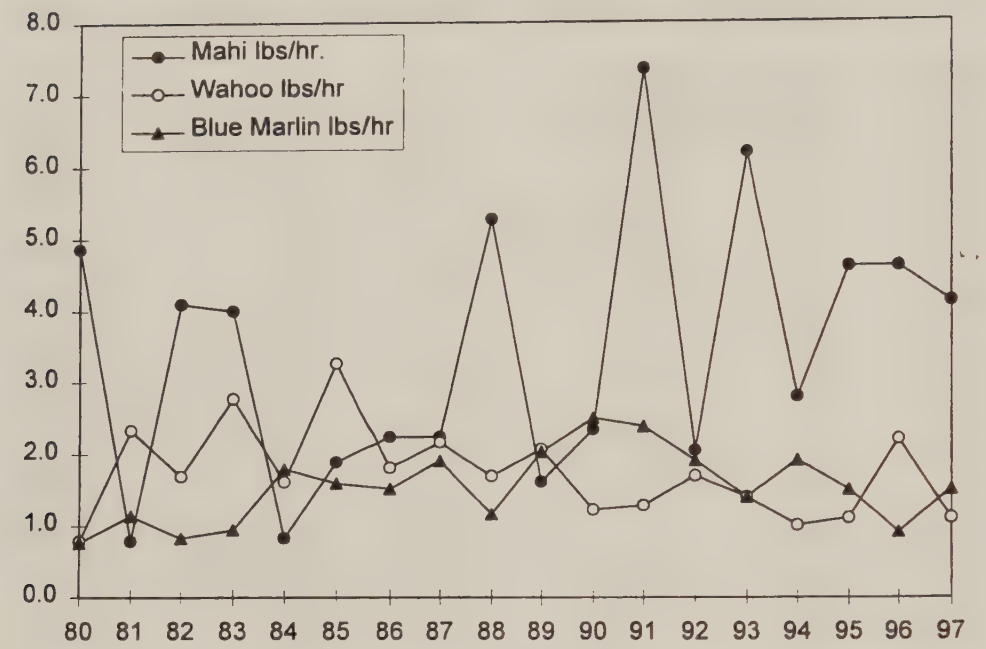
Interpretations: The inflation-adjusted price of Tunas and other PPMUS showed a general decline during the past 15 years, but increased in 1997. A decrease in landings and effort, and high demand for fresh fish may have contributed to the increase in pelagic fish prices.

Source: The WPACFIN-sponsored commercial landings system.

Calculation: The average price of the Tunas and other PPMUS groups are calculated by dividing the total revenue for each by the sold weight. The inflation adjustment is made by using the Consumer Price Index (CPI) for Guam and establishing the current year figure as the base from which to calculate expansion factors for all previous years (e.g., divide the current year CPI by the CPI of any given year), and then multiplying that factor by the unadjusted average price for the given year.

	Price ($/lb.)			
	Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted
1980	1.21	4.21	1.29	4.50
1981	1.29	3.73	1.39	4.02
1982	1.25	3.46	1.39	3.82
1983	1.26	3.36	1.37	3.64
1984	1.22	2.98	1.38	3.37
1985	1.39	3.29	1.61	3.79
1986	1.41	3.23	1.47	3.37
1987	1.49	3.28	1.43	3.14
1988	1.31	2.73	1.39	2.90
1989	1.28	2.42	1.42	2.68
1990	1.62	2.67	1.71	2.82
1991	1.85	2.77	1.54	2.31
1992	1.70	2.32	1.62	2.20
1993	1.82	2.28	1.45	1.82
1994	1.73	1.86	1.67	1.79
1995	1.70	1.73	1.27	1.29
1996	1.62	1.64	1.52	1.54
1997	**1.65**	**1.65**	**1.76**	**1.76**
Average		**2.72**		**2.79**
Std Deviation		**0.74**		**0.94**

Figure 10. Guam trolling catch rates: mahimahi, wahoo, and blue marlin.



Interpretations: The wide fluctuations in CPUE are probably due to the high variability in the year to year abundance and availability of the stocks. However, since it is not possible to allocate species-specific effort, effort used to target other species can also result in artificially high or low catch rates for a given species. CPUE for mahimahi and wahoo decreased 11% and 50% respectively, while CPUE for blue marlin increased 67%. No general trend in CPUE is apparent.

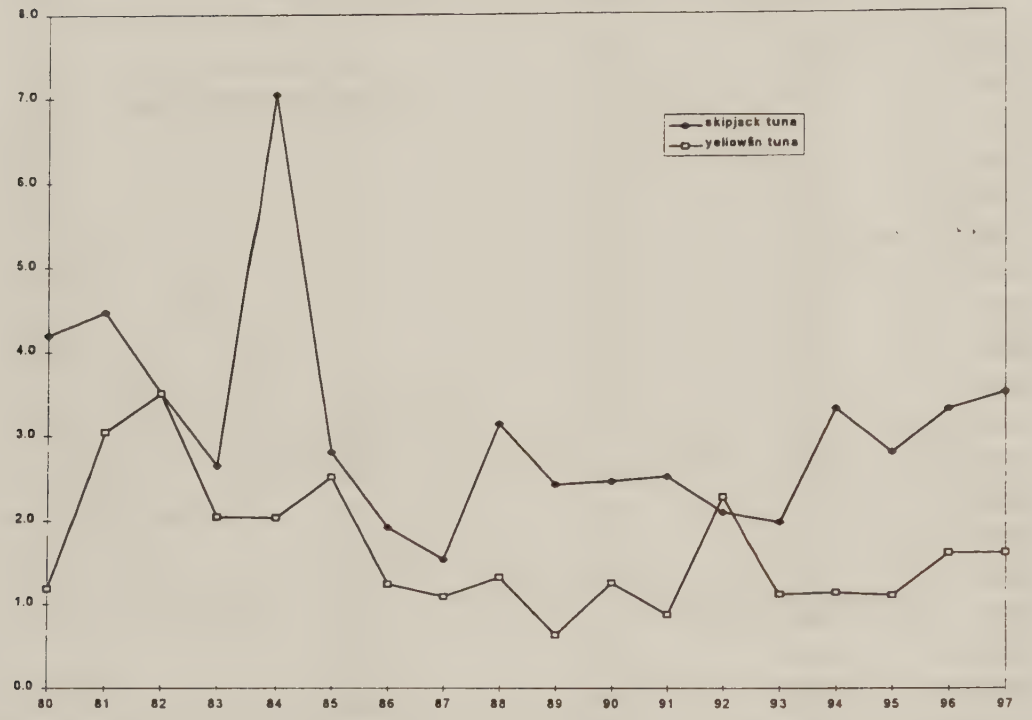
Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files, expanded with the assistance of NMFS.

Calculation: The data expansion system is run on a calendar year's worth of survey data to produce catch and effort estimates for each fishing method. This plot and table of catch per unit of effort (CPUE) are based on the total annual landings of mahimahi, wahoo, and blue marlin, each divided by the total number of hours spent fishing (gear in use).

Pounds Per Hour Fished

Year	Mahimahi	Wahoo	Blue Marlin
1980	4.9	0.8	0.8
1981	0.8	2.3	1.1
1982	4.1	1.7	0.8
1983	4.0	2.8	0.9
1984	0.8	1.6	1.8
1985	1.9	3.3	1.6
1986	2.2	1.8	1.5
1987	2.2	2.2	1.9
1988	5.3	1.7	1.2
1989	1.6	2.1	2.0
1990	2.3	1.2	2.5
1991	7.3	1.3	2.4
1992	2.0	1.7	1.9
1993	6.2	1.4	1.4
1994	2.8	1.0	1.9
1995	4.6	1.1	1.5
1996	4.6	2.2	0.9
1997	**4.1**	**1.1**	**1.5**
Average	**3.4**	**1.7**	**1.5**
Std Deviation	**1.9**	**0.6**	**0.5**

Figure 11. Guam trolling catch rates: skipjack and yellowfin tunas.



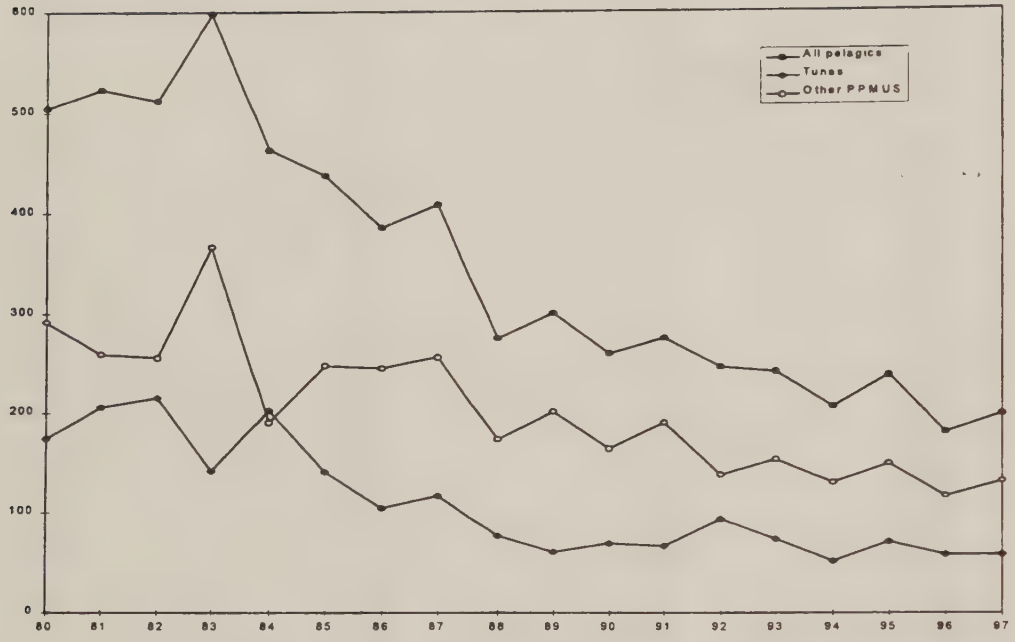
Interpretations: The wide fluctuations in CPUE for tunas are probably due to the high variability in the year to year abundance and availability of the stocks. It is also possible that a large annual effort directed at one or more other trolling species could result in an artificial decline in the CPUE of the species shown here. The catch rate for yellowfin remained the same compared with 1996, while only a slight increase in the catch rate of skipjack tuna was observed.

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files,expanded with the assistance of NMFS.

Calculation: The data expansion system is run on a calendar year's worth of survey data to produce catch and effort estimates for each fishing method surveyed. This plot and table were calculated in the same way as figure 10.

Year	Pounds Per Hour Fished Skipjack Tuna	Yellowfin Tuna
1980	4.2	1.2
1981	4.5	3.0
1982	3.5	3.5
1983	2.6	2.0
1984	7.1	2.0
1985	2.8	2.5
1986	1.9	1.2
1987	1.5	1.1
1988	3.1	1.3
1989	2.4	0.6
1990	2.5	1.3
1991	2.4	0.8
1992	2.1	2.3
1993	2.0	1.0
1994	3.3	1.1
1995	2.8	1.1
1996	3.3	1.6
1997	**3.5**	**1.6**
Average	**3.1**	**1.6**
Std Deviation	**1.3**	**0.8**

Figure 12: Guam inflation-adjusted revenues per trolling trip landing tunas or other PPMUS species.



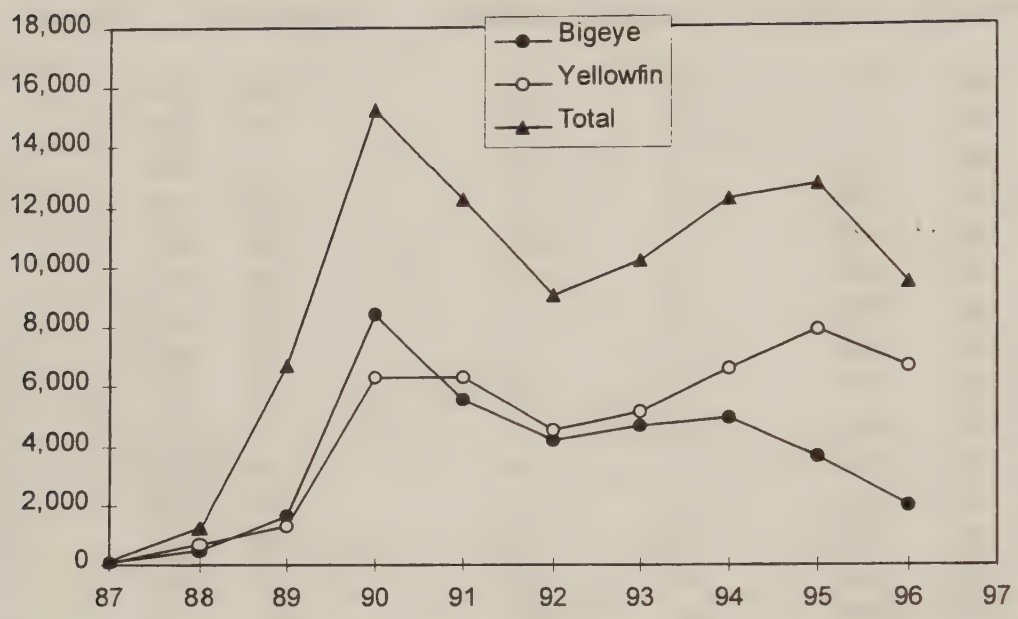
Interpretation: Adjusted revenue per trip for all pelagics, tunas and other PPMUS have experienced a general decline during the past 15 years, In 1997, adjusted revenues for all pelagics increased 10%, remained the same for tunas, and increased 13% for other PPMUS. One must be careful in interpreting these data for the Guam fishery because they were subject to biases created by marketing problems and the market structure upon which the data collecting system is based. For example, 1988, 1991, and 1993 were record high years for abundance and landings of mahimahi. One might expect the per-trip landings to be high for a year which had record landings. In years past, gluts on the market during mahimahi season of previous years and other marketing problems resulted inlow revenues per trolling trip. In 1997, however, several major fish vendors competed for pelagic fish, with the Fishermen's Coop placing no limit on fish sold to it by its member. Despite revenues increasing or decreasing, effort still occurs since most charter boats and non-charter boats do not rely on selling their fish for a living.

Source: The WPACFIN-sponsored commercial landings system.

Calculation:The average revenue per trip was calculated by summing the revenue of all species sold then dividing by the number of trips, and summing the revenue of tunas and other PPMUS sold, and then dividing each by the number of trips, respectively, for any trip which landed PPMUS. Adjusted revenue per trip was derived from the Guam Annual Consumer Price Index (CPI).

	Revenues per trip ($)					
	All Pelagics		Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
1980	144	504	50	175	84	291
1981	181	523	71	206	89	259
1982	186	512	78	216	93	256
1983	224	598	53	142	137	366
1984	189	463	83	203	78	191
1985	185	437	60	141	105	247
1986	168	385	45	104	107	245
1987	185	408	53	117	116	256
1988	132	275	37	77	83	174
1989	159	300	32	61	107	201
1990	157	259	42	69	99	164
1991	183	275	45	67	127	190
1992	181	246	69	93	102	138
1993	192	241	59	74	122	153
1994	192	206	48	48	121	130
1995	234	238	70	71	146	149
1996	185	181	59	58	119	116
1997	**199**	**199**	**58**	**58**	**131**	**131**
Average		**347**		**110**		**203**
Standard Deviation		**132**		**57**		**67**

Figure 13. Annual Guam longline landings from primarily foreign longliners fishing primarily outside the Guam EEZ.



Interpretation:

Source: The Guam Department of Commerce.

Calculation: Pre-1990 data was extracted directly from transshipment agents' files. Beginning in 1990, a mandatory data submission program was implemented.

Year	Total (tons)	Bigeye tuna (tons)	Yellowfin tuna (tons)
1987	144	60	72
1988	1,236	462	682
1989	6,691	1,615	1,274
1990	15,278	8,433	6,283
1991	12,264	5,549	6,279
1992	9,017	4,150	4,537
1993	10,207	4,630	5,126
1994	12,283	4,896	6,553
1995	12,733	3,658	7,872
1996	9,460	2,014	6,653

Appendix 3

Hawaii

Highlights

Overall Hawaii pelagic landings in 1997 probably increased, primarily due to the substantial growth in landings by the Hawaii-based domestic longline fishery. Handline and troll landings of pelagics appear to have declined in 1997, although there may be a seasonal bias in the extrapolation technique used to account for under-reporting. Aku boat (pole-and-line skipjack tuna) landings were stable.

Effort in the longline fishery in 1997 was directed toward tunas rather than swordfish (with resultant changes in catch composition). The number of active longliners declined in recent years as a number of vessels left Hawaii for U.S. mainland fisheries. In the latter part of 1997, 15 longline vessels migrated to California and fished mainly swordfish. All but one returned in early 1998. In addition, three "new" boats entered the fishery and six Atlantic swordfish returned to Hawaii. As a results, there was a substantial decrease in Hawaii-based swordfish-directed longline fishing effort in the fourth quarter of 1997 and there will probably be an increase in the first two quarters of 1998. However, low prices for swordfish has encouraged a number of these new or re-entrants to switch to targeting tuna.

Probably the most significant change over the past several years has been the shift of longline effort out of swordfish into tuna. The number of swordfish-directed trips has declined from 319 in 1993 to just 78 trips in 1997. Meanwhile tuna-directed trips have increased from 542 to 765 over the same period.

Swordfish CPUE (catch per unit effort) on swordfish-directed longline trips is returning to its pre-1994 levels (15.4 swordfish per 1,000 hooks in 1997), but this represents a very low level of effort.[1] It is possible that swordfish CPUE in earlier years when there was more effort represented the combined, and potentially off-setting effect, of localized competition and coordinated search efforts.

Finally, albacore landings by longline, handline, and other gear types have increased dramatically in the past 5 years. Much of this is being "exported" to California and the East coast as a fresh-frozen product. Whether this will become a significant market sector probably depends on continuing availability of albacore and these new markets, as well as the relative abundance of higher priced tunas (i.e., bigeye) and swordfish.

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[1] 1994 was a year of evidently abnormally low swordfish catch rates.

It is difficult to comment on the apparent decline in 1997 landings by the troll and handline sectors because of the potential seasonal bias in the extrapolation.

A number of fishery management issues continue to percolate in the Hawaii pelagic fishery. Shark finning by longline and other vessels is one issue, as well as the problem of protected species interactions (marine turtles and sea birds) in the longline fishery. Considerable research effort is being directed toward the interactions problem by National Marine Fisheries Service (NMFS), and the Council is collaborating with the U.S. Fish & Wildlife Service on the seabird problem. The fishery interaction between some longline vessels and a number of offshore seamount handline vessels is another issue being faced by the Council. Finally, issues have been raised concerning the use of blue marlin as a commercial landing by both the longline fishery as well as in the charter fishery. Some of the JIMAR economic research provide information on the relative values of blue marlin to the various fisheries sectors in Hawaii, but other questions continue concerning fishery interactions.

Information & Sources

This report contains the most recently available information on Hawaii's commercial pelagic fishery. Commercial fisheries data are compiled from two sources: The State of Hawaii's Division of Aquatic Resources (HDAR) commercial catch reports, and the U.S. National Marine Fisheries Service (NMFS) Honolulu Laboratory longline logbooks and marketing monitoring samples.[2] Data on the recreational fishery are not available since recreational fishers are not required to file landings reports (if they sell no fish during the year) and there is no comprehensive creel survey of Hawaii anglers. A recent JIMAR research report gives some idea of the relationship between commercial and recreational pelagic fishing, but estimates of total recreational landings remain absent.[3]

The module was prepared using preliminary 1997 NMFS. NMFS longline data for 1991-96 were updated and can be considered "final", and the 1997 longline data are essentially complete. HDAR commercial catch reports for 1997, which comprise the troll, handline, pole-and-line, and other gears data, were about 90% complete when the module was prepared. As a result, a 10% extrapolation factor was applied to all HDAR data for 1997. HDAR troll-handline-other gear data for 1996 was updated. "Final" NMFS and HDAR figures for 1997 will appear in the annual report for 1998.

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[2] Ito, Russell Y. and Walter A. Machado. 1997. Annual report of the Hawaii-based longline fishery for 1996. Southwest Fisheries Science Center administrative report H-97-12.

[3] Hamilton, Marcia S and Stephen W. Huffman. 1997. Cost-earnings study of Hawaii's small boat fishery, 1995-96. University of Hawaii SOEST 97-06/JIMAR 97-314. 102 p.

Data for previous years (including a time-series back to 1948 but primarily data from 1987) were updated extensively in last year's report to correct previous figures and estimates and to use consistent time-series data for comparison purposes. Information in graphs included in this year's report were generally updated from 1992. In some cases there may be inconsistencies between alternative data sets. Where possible, these are being rectified. However in some cases where estimation procedures were employed (e.g., the 1979-1986 longline time-series), differences will reflect different methods of dealing with missing information. Small differences between species tables and gear tables may also exist due to rounding and differences in defining relevant gear types and species groupings.

The module was prepared by Sam Pooley, NMFS. Information on longline catch and logbooks was provided by Russell Ito and Frederick Dowdell, NMFS. Information on HDAR Commercial Marine Licenses and troll-handline catch rates was provided by Walter Ikehara and Reginald Kokubun, HDAR and compiled by Frank Cabacungan, NMFS.

A WordPerfect template approach which integrated tables and charts was initiated several years ago and was a tremendous advantage over previous methods for presenting information because it allowed for changes in graphs without requiring re-generation of the graphics in a separate software package and importing the graph "pictures" into the WP text. However the table and graph data used in WP6 must be entered separately (or "cut & paste"). Furthermore, the latest versions of WP8/7/6 using Presentation have substantial bugs which affect chart formats whenever new data are entered and which preclude use of some methods for integrating tables with spreadsheets. This means that changes to the modules are much more time-consuming and consistency in appearance is more difficult. Hopefully these problems will be rectified in future versions of the software.[4]

[4] Using Microsoft Word is no help in either of these regards.

Hawaii commercial marine license information[5]

Every fisherman, including crew members on commercial fishing vessels, who sells any marine species is required by the State to have a Commercial Marine License (CML) and, unless specifically exempted[6], is required to submit a catch report monthly to HDAR.

A total of 3,658 fishermen were licensed by the State of Hawaii in calendar year 1997, of which 2,796 were required to file monthly catch reports. As of April 1998, HDAR had received 28,342 monthly reports (82.9% of the 34,201 monthly reports expected based on the number of license holders and the number of months in 1997 in which they held their licenses).

HDAR asks fishermen to identify their primary fishing gear or method on the Commercial Marine License at time of licensing. This does not preclude fishermen from using other gears or methods, but it indicates what they consider to be their primary fishing method.

Primary fishing method	**Number of licenses**	
	1996	**1997**
Trolling	1,586	1,589
Longline	561	474
Ika shibi & palu ahi	186	170
Baitboat	42	45
Total pelagic	2,375	2,278
Total all methods	3,664	3,658

5 Data provided by the Hawaii Division of Aquatic Resources.

6 Only one person per vessel or fishing trip is required to submit a catch report. This person is usually, but not always, the captain. (The captain may or may not be the vessel owner.) Crew members are generally not required to submit catch reports.

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Table 1. Hawaii domestic commercial landings, revenue and prices[7], 1996-97.

Species	1996 Pounds Landed (x 1,000)	1996 Ex-vessel Revenue (x $1,000)	1996 Average Price ($/lb)	1997 Pounds Landed (x 1,000)	1997 Ex-vessel Revenue (x $1,000)	1997 Average Price ($/lb)
Swordfish	5,500	13,800	2.51	6,400	14,100	2.20
Blue marlin	1,900	1,700	0.89	1,800	1,400	0.78
Striped marlin	1,000	1,200	1.20	900	1,100	1.22
Other billfish	300	300	1.00	400	300	0.75
Mahimahi	900	1,800	2.00	1,100	1,700	1.55
Wahoo	500	1,200	2.40	800	1,300	1.63
Moonfish	800	800	1.00	800	900	1.13
Sharks[8]	4,300	1,800	0.42	5,000	2,000	0.40
Other pelagics	100	200	2.00	200	300	1.50
Non-Tuna PMUS Subtotal	**15,300**	**22,800**	**1.49**	**17,400**	**23,100**	**1.33**
Albacore	3,100	3,800	1.23	3,900	4,700	1.21
Bigeye tuna	4,300	14,600	3.40	5,500	17,600	3.20
Bluefin tuna	100	900	9.00	100	800	8.00
Skipjack tuna	2,400	2,900	1.21	2,500	3,000	1.20
Yellowfin tuna	3,800	8,900	2.34	4,200	10,200	2.43
Tuna PMUS Subtotal	**13,700**	**31,100**	**2.27**	**16,200**	**36,300**	**2.24**
TOTAL	**29,000**	**53,900**	**1.86**	**33,600**	**59,400**	**1.77**

Data: Data are combined from NMFS longline estimates and HDAR commercial catch reports for other pelagic gears. (See subsequent tables for details.) Due to rounding, totals between tables may differ.

Data Source: Imported from P8797N.xls (7/6/98)

Interpretation: Total landings increased by 16% while revenue increased by 11%. Ex-vessel prices were lower in general. Swordfish and bigeye tuna continue to dominate pelagic landings in Hawaii. Swordfish landings increased substantially in 1997 even though the number of

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7 Average price is calculated for this table as (*Ex vessel revenue / Pounds Landed*), rather than *Pounds Sold.*

8 Shark "landings" represent estimated whole weight, often of sharks whose dried fins were the portion actually landed.

swordfish-directed longline trips declined. Bigeye landings also increased substantially, as tuna-directed longline trips increased. (Longline statistics are discussed more fully in subsequent tables.) Albacore landings continued to show their strong increasing trend.

Blue marlin landings appear to have declined, with the decline caused by a decline in the troll-handline gear landings. (These show a substantial inter-annual variation, as discussed later.) Other landings were within their usual ranges, except for shark (estimated whole weight) which continues to increase as the market for shark fins remained strong in 1997. This market may weaken in 1998 due to the Asian economic problems.

Table 2. Hawaii commercial pelagic landings and revenue by gear, 1996-97.

Gear	Pounds Landed (x 1,000)	Pounds Sold (x 1,000)	Ex-vessel Revenue (x $1,000)	Average Price ($/lb)
1996				
Baitboat	1,800	1,800	2,400	1.33
Handline[9]	2,700	2,600	4,800	1.85
Longline	21,500	21,500	42,800	1.99
Trolling	3,000	2,600	4,800	1.85
Other[10]	90	70	70	1.00
TOTAL	**29,090**	**28,570**	**54,870**	**1.92**
1997				
Baitboat	1,900	1,900	2,400	1.26
Handline	1,500	1,400	2,700	1.93
Longline	27,100	27,100	49,900	1.84
Trolling	2,900	2,400	4,300	1.79
Other	100	100	100	1.00
TOTAL	**33,500**	**32,900**	**59,400**	**1.81**

Data: Data are from HDAR commercial catch reports for the non-longline pelagic gears and NMFS estimates for longline. HDAR commercial catch reports are categorized into Baitboat (pole-and-line targeting skipjack tuna); handline (*ika shibi, palu ahi*, and miscellaneous handline techniques) targeting tunas; trolling (targeting tunas, billfish, mahimahi, and ono); and various other pelagic gears. Due to rounding, totals between tables may differ. Time-series data is included later in the module.

Data Source: Imported from GAS97x.dbf (7/6/98) and P8796n.xls (7/8/98)

Interpretation: Longline landings increased substantially in 1997. The total number of trips barely increased, but as the number of tuna-directed trips increased, the total number of hooks set increased by almost 20%. Catch rates of the major target species for longline gear increased (swordfish and bigeye tuna). In addition, there was a higher retention of sharks (for finned product).

Pelagic handline landings appear to have declined substantially in 1997, but it is not clear to which the extrapolation procedure may have biased the results. Trolling landings were stable.

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9 Pelagic handline only.

10 Other includes unknown.

It appears that baitboats (pole-and-line skipjack (*aku*)) continued their relatively low level of landings (compared to the period before the closure of the Honolulu tuna cannery in 1984), with landings remaining relatively similar between 1996 and 1997.

Table 3a. Hawaii longline landings and revenue, 1996-97.

Species	1996 Landings (x 1,000 lb)	1996 Revenue (x $1,000)	1997 Landings (x 1,000 lb)	1997 Revenue (x $1,000)
Swordfish	5,500	13,700	6,350	14,000
Blue marlin	1,000	1,000	1,100	900
Striped marlin	900	1,100	800	1,000
Mahimahi	400	800	500	600
Moonfish	800	800	800	900
Ono (wahoo)	100	300	250	400
Sharks	4,300	1,800	5,000	2,000
Other	400	500	500	600
Non-Tuna PMUS Subtotal	**13,400**	**20,000**	**15,300**	**20,400**
Albacore	2,600	3,400	3,600	4,500
Bigeye	4,000	14,100	5,400	17,400
Bluefin	50	900	50	800
Skipjack	100	50	250	200
Yellowfin	1,400	4,250	2,500	6,700
Tuna PMUS Subtotal	**8,150**	**22,700**	**11,800**	**29,600**
TOTAL	**21,550**	**42,700**	**27,100**	**50,000**

Data: Data are from NMFS Honolulu Laboratory compilations based on Federal logbooks filed by domestic longliners operating out of Hawaii.

Landings are estimates compiled by multiplying NMFS logbook figures for number kept per species by average weight per species from NMFS market monitoring in Honolulu. Data for 1997 are from preliminary average weights.

Revenue is based on whole weight prices. Swordfish and shark are adjusted to whole-weight estimates.

Data Source: Imported from LL97RI_A.cal (3/20/98)

Interpretation: *Changes in aggregate species composition should be qualified by reference to changes in longline trip type (see following table).*

Overall longline landings have grown substantially in the past three years, with 1997 being the highest longline landings ever in Hawaii. Landings of each tuna species increased in 1997, and swordfish landings also increased. Tuna landings were up over 45% in 1997. Swordfish landings have been relatively stable in the past several years, following the change in targeting patterns to tuna in 1994-95. Other pelagic species (e.g., mahimahi, ono, moonfish, and shark (fins)) were at their highest levels. Shark landings increased as shark finning continues to be a major source of income, particularly for some sectors of the fishery (with crews frequently receiving most if not

all of a vessel's dried shark fin revenue). Albacore landings continued to increase; in both 1996 and 1997 they exceeded yellowfin tuna landings.

More detailed information on longline catch and effort statistics is included in the NMFS annual report on the fishery compiled by Russell Ito, Honolulu Laboratory.

Table 3b. Hawaii longline catch per unit effort by trip type[11], 1996-97.

Species	1996 All Trips	1996 Swordfish Trips	1996 Mixed Trips	1996 Tuna Trips	1997 All Trips	1997 Swordfish Trips	1997 Mixed Trips	1997 Tuna Trips
Blue marlin	0.46	0.19	0.84	0.38	0.53	0.39	1.16	0.41
Striped marlin	1.10	0.50	1.02	1.17	0.81	0.58	1.18	0.75
Swordfish	2.65	14.17	7.56	0.17	2.55	15.41	9.97	0.14
Mahimahi	1.62	2.26	3.42	1.03	3.17	10.24	9.12	1.46
Moonfish	0.51	0.04	0.08	0.68	0.53	0.01	0.06	0.66
Ono (wahoo)	0.31	0.22	0.16	0.36	0.53	0.29	0.35	0.59
Sharks	7.01	25.52	15.29	2.90	5.52	14.20	16.39	2.68
Albacore	3.98	5.79	3.45	3.98	4.57	2.87	2.77	5.05
Bigeye tuna	4.41	1.43	4.26	4.73	5.13	3.13	3.12	5.68
Yellowfin tuna	1.22	0.71	1.68	1.13	1.87	1.87	3.30	1.57
Number of trips	**1,100**	**92**	**351**	**652**	**1,124**	**78**	**301**	**745**
Number of hooks set	**14,401,531**	**932,777**	**3,080,174**	**10,388,580**	**15,558,771**	**840,539**	**2,512,069**	**12,206,163**
Number of lightsticks	**923,349**	**311,280**	**562,445**	**49,624**	**879,331**	**292,914**	**546,149**	**40,268**

[Data source and Interpretation on following page]

[11] Trip type refers to the primary species target for each trip. (See *Data* description below).

Data: Data are from NMFS Honolulu Laboratory compilations based on Federal logbooks filed by domestic longliners operating out of Hawaii. ***CPUE*** is the number of fish caught per 1,000 longline hooks. *Trip Type* refers to the identification of the primary target species for a particular trip, either as indicated by the vessel captain to NMFS logbook collection staff or designated by NMFS in the absence of a captain's designation.

Data Source: NMFS longline logbook summaries (LLCS 8/12/97 & 4/29/98).

Interpretation: This table shows the substantial difference in interpretation that categorization of CPUE by trip type can make. Swordfish trips have twice the swordfish CPUE as Mixed trips, while swordfish is a small incidental catch in Tuna trips. The aggregate (All Trips) CPUE figures are not good indicators of catchability or abundance, although they do indicate the relative importance of particular species within the fishery as a whole.

Swordfish trip CPUE for swordfish increased in 1997, although somewhat fewer swordfish-directed hooks were set in 1997 than in 1996. Mixed trip CPUE for swordfish increased as well, although mixed trip hooks set decreased. More lightsticks were used per set in both swordfish and mixed trips. Mixed trip CPUEs for albacore and bigeye declined and were not as high in 1997 as in 1996 or 1995, but yellowfin catch rates were higher.

Catch of shark remains relatively high in Swordfish and Mixed trips (compared to target species), but relatively low in Tuna trips. Shark CPUEs were lower in 1997 than in 1996. Approximately 55% of all sharks were retained (most as fins).

Mahimahi was much more available in 1997 compared to 1996 (a typical pattern of biannual variation in apparent abundance or catchability), while most other pelagic species were about the same.

Tuna trip CPUEs for albacore, bigeye, and yellowfin tuna were higher in 1997. The number of hooks set by Tuna trips continues to increase. Mixed trips appear to have targeted swordfish more in 1997.

More detailed information on longline CPUE statistics will be included in the NMFS annual report on the fishery being compiled by Russell Ito, Honolulu Laboratory.

Table 3c. Hawaii longline catch (number of fish caught) by area fished[12], 1996-97.

Species	1996 All Locations	1996 MHI EEZ	1996 NWHI EEZ	1996 Outside of U.S. EEZs	1997 All Locations	1997 MHI EEZ	1997 NWHI EEZ	1997 Outside of U.S. EEZs
Blue marlin	6,685	3,556	1,114	1,878	8,253	4,083	1,519	2,457
Striped marlin	15,789	7,163	4,184	4,250	12,636	4,192	4,109	4,080
Swordfish	38,225	4,634	3,987	29,495	39,682	4,873	5,148	29,627
Mahimahi	23,331	11,676	1,995	9,507	49,318	11,660	6,320	30,730
Moonfish	7,315	3,094	2,388	1,776	8,254	2,847	2,887	2,314
Ono (wahoo)	4,461	1,527	659	2,116	8,312	2,525	1,789	3,668
Sharks	101,002	19,428	16,539	64,081	85,816	16,461	17,914	49,935
Albacore	57,329	19,259	12,738	23,719	71,084	19,025	17,118	30,887
Bigeye tuna	63,575	29,803	15,409	17,588	79,776	21,395	30,162	26,149
Yellowfin tuna	17,586	7,715	1,089	6,227	29,043	10,980	5,139	10,990
Trips[13]	**1,137**	**772**	**295**	**626**	**1,161**	**686**	**390**	**660**
Hooks 1,000s	**14,141**	**5,901**	**2,855**	**5,152**	**15,559**	**5,054**	**4,095**	**5,968**
Lightsticks 1,000s	**923**	**154**	**117**	**649**	**879**	**132**	**128**	**619**

MHI: Main Hawaiian Islands
NWHI: Northwestern Hawaiian Islands
EEZ: Exclusive Economic (200-mile) Zone

[Data source and Interpretation on following page]

12 Only the three areas with the largest catch are tabled here. The balance reflects landings in U.S. possessions or landings where locations were not verified.

13 Total trips are not additive across areas because trips may intersect more than one area. Totals may also differ between tables because of different data compilation dates.

Data: Catch is *Number Caught* based on Federal logbooks filed by domestic longliners operating out of Hawaii. The Main Hawaiian Islands (MHI) EEZ (Exclusive Economic Zone) represents all longline catch within 200 miles of the eight main islands of Hawaii, except for the overlap with the Northwestern Hawaiian Islands (NWHI). Catch in other U.S. EEZ areas includes the EEZs for U.S. possessions in the central and western Pacific (e.g., Wake Island).

Data Source: NMFS longline logbook summaries (LLCS 8/12/97 & 4/29/98)

Interpretation: Longline fishing effort (as measured by number of hooks set) increased by about 10% in 1997. However the locations of that effort changed again. Fishing was relatively evenly distributed between the three main fishing areas (97% of total effort). There has been increased fishing in the 200-mile EEZ of the NWHI (outside the 50 mile protected species zone).

Bigeye tuna were caught in record numbers in 1997, as were albacore. Most bigeye tuna was caught in the NWHI EEZ this year, whereas it was primarily caught within the MHI EEZ in earlier years. Slightly less than half the albacore is caught outside the EEZs.

As would be expected, most swordfish was caught outside the EEZs. Almost half the blue marlin was caught within the MHI EEZ.

The number of shark caught declined by 20% in 1997. Over half the sharks were caught outside the Hawaii EEZs, confirming the relatively pelagic and migratory nature of the blue sharks which predominate in the catch (93% of all sharks caught).

More detailed information on longline catch and effort statistics will be included in the NMFS annual report on the fishery being compiled by Russell Ito, Honolulu Laboratory.

Table 4a. Average estimated round weight (in pounds) of fish by gear type, 1987-97.

Year	Non-Tuna PMUS					Tunas			
	Swordfish	Blue marlin	Striped marlin	Mahimahi	Wahoo (ono)	Albacore	Bigeye	Skipjack (aku)	Yellowfin
				Longline					
1987	129	161	66	21	33	62	76	--	82
1988	119	157	57	20	32	60	83	--	103
1989	131	165	62	23	35	62	77	--	104
1990	148	198	62	19	36	61	80	--	122
1991	155	175	59	15	32	52	85	20	118
1992	178	175	66	11	35	45	77	17	99
1993	172	157	64	13	33	44	88	17	92
1994	163	171	64	12	34	41	81	18	97
1995	171	157	58	10	31	50	79	18	95
1996	157	154	58	17	31	53	64	17	80
1997	**163**	**134**	**66**	**13**	**30**	**54**	**71**	**20**	**89**
Average	153	164	62	16	33	53	78	18	98
Standard Deviation	19	16	3	4	2	8	7	1	13

[Data source and Interpretation on following page]

Data: Longline data are from NMFS Honolulu Laboratory market monitoring. Where fish are presented in less than whole form, conversion factors are applied to convert to whole weight. This is not frequent for longline landings (except for swordfish). Sharks are not included in this average weight table because of inadequate samples (most shark is "landed" only as a finned product.)

Data source: Imported from LL97RI_A.cal (3/20/98)

Interpretation: Analysis of any changes in size composition for species which are caught in multiple locations (e.g., MHI vs. out of the EEZ) is difficult without identification of the catch location. What is significant about the average sizes is the relatively slight change in average weight over time and the relatively small standard deviations for most species. Average swordfish weights were amongst their highest in 1997, while blue marlin were the smallest over the time series. This may be explained by the fact that relatively more blue marlin were caught outside the EEZ in 1997 compared to 1996.

More detailed analysis of weight composition is found in NMFS annual longline monitoring reports.

Table 4b. Average estimated round weight (in pounds) of fish for troll-handline-other gears, 1987-97.

Year	Non-Tuna PMUS					Tunas			
	Swordfish	Blue marlin	Striped marlin	Mahimahi	Ono (wahoo)	Albacore	Bigeye	Skipjack (aku)	Yellowfin
	Troll-Handline-Other								
1987	126	215	66	21	24	33	14	7	32
1987	124	181	64	18	25	64	34	7	32
1988	107	188	68	21	25	55	24	11	44
1989	97	248	76	20	25	58	25	7	41
1990	122	197	63	15	23	53	29	9	34
1992	75	215	70	14	26	53	28	6	27
1993	139	182	67	14	24	55	22	7	44
1994	95	233	67	14	27	53	30	9	37
1995	110	204	61	16	24	22	18	7	30
1996	86	195	65	16	23	42	24	12	42
1997	**92**	**174**	**68**	**16**	**21**	**36**	**16**	**11**	**33**
Average	107	203	67	17	24	48	24	8	36
Standard Deviation	19.6	23.0	4.0	2.8	1.6	12.7	6.2	2.1	5.9

[Data source and Interpretation on following page]

Data: Troll-handline-other gear data are from HDAR commercial catch reports (*pounds caught* divided by *number caught* where *number caught* > *0*). Correction cannot be made for weights of processed fish (e.g., headed and gutted) which might have been recorded in processed form. Average weight is calculated as Pounds Caught *divided by* Number Caught. *Other* gear represents all other gears except troll, handline, longline, and baitboat. In 1995 albacore landings and weights are strongly influenced by distant-water albacore troll landings.

Data source: annual GASyr.dbf (7/6/98)

Interpretation: All species caught by trolling, handline, or other gears are within their recent ranges, except for albacore. Albacore are much lower in size in 1995 due to substantial landings in Honolulu by distant-water albacore trollers, which tend to catch smaller fish than the other gears.

Table 5a. Hawaii longline vessel activity (trips), 1991-1997.

Year	Total Trips	Tuna Trips	Mixed Trips	Swordfish Trips
1991	1,670	556	823	291
1992	1,265	458	530	277
1993	1,192	542	331	319
1994	1,106	568	228	310
1995	1,125	682	307	136
1996	1,100	657	351	92
1997	**1,124**	**745**	**301**	**78**
Average	1,226	601	410	215
Standard Deviation	204	98	204	108

Data: Data compiled by the NMFS Honolulu Laboratory's Fishery Monitoring & Economics Program from NMFS Federal logbooks. Type of trip is usually determined by interview with the vessel captain or occasionally by FMEP staff interpretation of salient characters from fishing vessel gear design, fishing locations, and catch composition. Detailed longline effort data is only available beginning in the 1991 calendar year when Federal logbooks went into effect.

Data Source: NMFS longline logbook summaries (LLCS 4/29/98).

Interpretation: This table shows the decline in the number of longline trips in Hawaii from the moratorium on new entry in 1991 through 1994, at which point trip effort stabilized. The table also shows the dramatic shift from swordfish-targeted trips toward tuna (primarily bigeye tuna) and mixed trips in 1995, and the decline of swordfish-directed fishing effort. As a result of this shift, interpretation of longline catch statistics should reflect the changing nature of longline targeting practices.

Table 5b. Hawaii longline vessel activity (miles to first set and days fishing), 1991-1997.

Year	All Trips			
	Average		Maximum	
	Miles to first set	Days fishing	Miles to first set	Days fishing
1991	318	7.6	1,792	22
1992	424	9.5	1,871	26
1993	465	10.3	2,122	29
1994	430	10.0	2,814	26
1995	441	10.2	2,097	27
1996	367	10.5	2,037	30
1997	**332**	**10.5**	**1,973**	**36**
Average	416	9.5	2,139	26
Standard Deviation	54	1.0	311	4

Year	Average					
	Tuna Trips		Mixed Trips		Swordfish Trips	
	Miles to first set	Days fishing	Miles to first set	Days fishing	Miles to first set	Days fishing
1991	240	7.7	276	6.3	585	10.7
1992	260	8.4	404	7.8	733	12.7
1993	222	8.8	522	9.6	820	13.7
1994	252	8.9	323	8.0	833	13.4
1995	273	10.0	397	9.3	884	13.2
1996	284	10.3	410	10.3	790	12.7
1997	**288**	**10.1**	**365**	**10.6**	**623**	**14.1**
Average	249	8.8	384	8.2	771	12.7
Standard Deviation	22	0.9	72	1.4	104	1.0

Year	Maximum					
	Tuna Trips		Mixed Trips		Swordfish Trips	
	Miles to first set	Days fishing	Miles to first set	Days fishing	Miles to first set	Days fishing
1991	1,508	18	1,408	22	1,792	26
1992	1,156	14	1,543	21	1,871	26
1993	1,432	14	1,616	23	2,122	29
1994	945	16	1,298	19	2,814	26
1995	945	20	1,609	26	2,097	27
1996	1,866	28	1,547	30	2,037	28
1997	**1,002**	**19**	**1,323**	**36**	**1,973**	**27**
Average	1,197	16.4	1,495	22.2	2,139	26.8
Standard Deviation	325	4.5	124	5.6	311	1.1

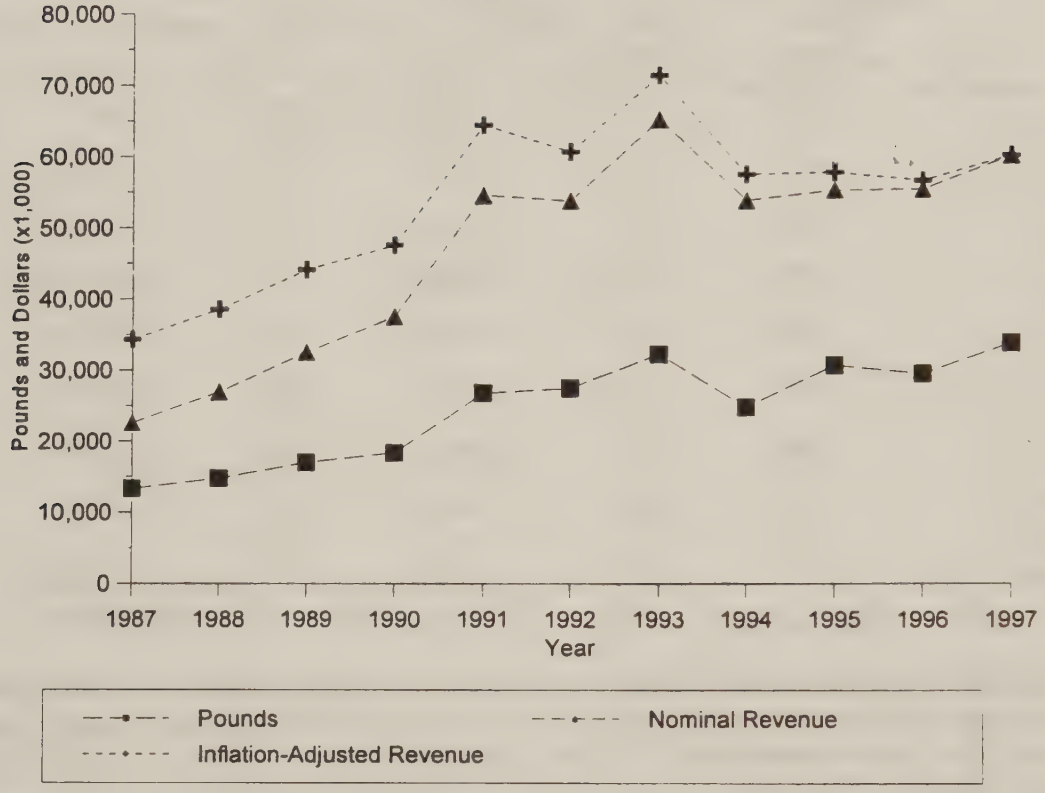
Interpretation: These tables show no dramatic changes for fishing activity by any of the three trip types. Average miles to first set and days fished for tuna and mixed trips were slightly above average in 1996. The furthest distant tuna trip occurred in 1996 by a substantial amount (1,866 miles from Honolulu) but the other trip types were within their norms. Some longline vessels targeting swordfish began trips in Honolulu but off-loaded in California in 1997. Although logbooks for most of these trips are available, they are not included in this data base.

Data: Data compiled by the NMFS Honolulu Laboratory's Fishery Monitoring & Economics Program from NMFS Federal logbooks. Type of trip is determined by FMEP staff through interviews with vessel captains or categorization of fishing operations. (Beginning in 1996, a new variable was created on the longline logbook concerning target per set. These data are not included in this report.)

Miles to first set is determined as the distance from Honolulu to the first set as recorded on the logbook. Average days fishing is determined by the number of days on which sets and hauls occurred on an individual trip.

Source: NMFS Honolulu Laboratory FMEP programming (7/14/97)

Figure 1. Hawaii commercial pelagic landings and revenue (all gears and pelagic species).



Interpretation: Total pelagic landings and revenue data show the effect of the dramatic increase in longline landings from the mid-1980s through 1993 and the general stabilization of landings and revenue since then. Gear-specific changes are considered in later figures.

Data source on following page.

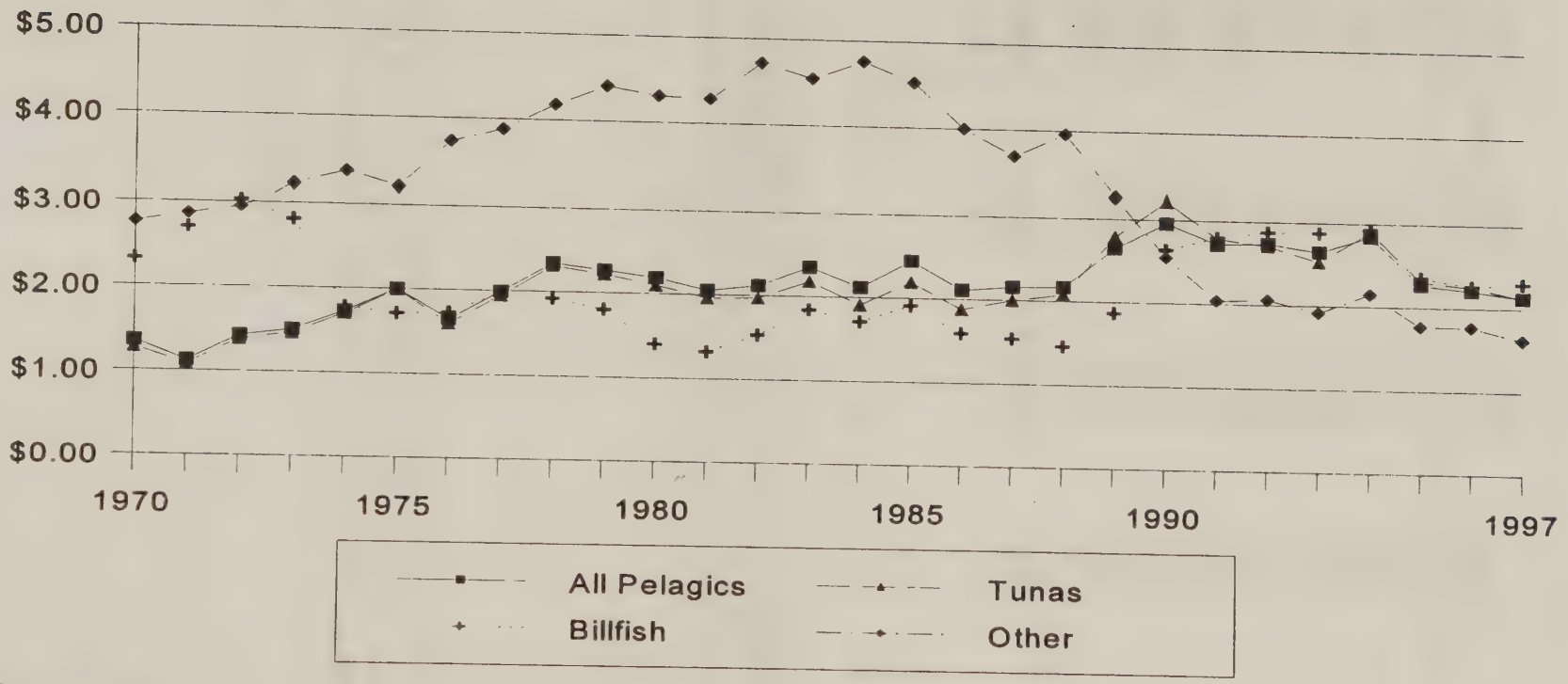
Hawaii commercial pelagic landings and revenue (all gears and species).

Year	Pounds (x 1,000)	Nominal Revenue (x$1,000)	Adjusted Revenue (x $1,000)	Honolulu Consumer Price Index (W)
1987	13,337	$22,597	34,295	115.90
1988	14,733	$26,873	38,493	122.80
1989	16,960	$32,442	43,998	129.70
1990	18,291	$37,399	47,361	138.90
1991	26,648	$54,306	64,153	148.90
1992	27,296	$53,483	60,344	155.90
1993	32,015	$64,853	70,987	160.70
1994	24,576	$53,422	57,055	164.70
1995	30,381	$54,781	57,221	168.40
1996	29,155	$54,803	56,013	172.10
1997	**33,421**	**$59,430**	**59,430**	**175.90**
Average	24,300	46,800	53,600	150.35
Standard Deviation	6,900	13,600	10,700	19.77

Data: Data are compiled from Hawaii Division of Aquatic Resources (HDAR) commercial catch reports for non-longline landings and from NMFS estimates of longline landings. Inflation-adjusted revenue is computed from the Honolulu consumer price index (HCPI) as: (Current year HCPI / data year HCPI) * data year nominal price (or nominal revenue).

Data Source: P8797n.xls (7/17/98)

Figure 2. Hawaii commercial ex-vessel pelagic prices, inflation-adjusted.[1]



Interpretation

Inflation-adjusted pelagic prices have declined for all major species groups over the past five years from peaks in 1990-91. Since landings have increased, such declines might be expected. An addendum to the Hawaii Fishing Industry and Vessel Economics project under the JIMAR Pelagic Fisheries Research Program is investigating price movements over the past few years; results should be available for next year's annual report.

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[1] Nominal annual average prices adjusted for inflation to most current year Honolulu consumer price index level. (All data must be updated annually.)

Hawaii commerical pelagic prices, inflation-adjusted [1].

Year	All Pelagics	Tuna	Billfish	Other
1970	1.35	1.27	2.32	2.76
1971	1.12	1.08	2.70	2.86
1972	1.42	1.38	3.03	2.95
1973	1.50	1.46	2.81	3.21
1974	1.73	1.70	1.78	3.36
1975	2.00	1.99	1.71	3.20
1976	1.65	1.60	1.73	3.73
1977	1.99	1.94	1.97	3.88
1978	2.34	2.31	1.92	4.18
1979	2.27	2.22	1.80	4.41
1980	2.19	2.10	1.40	4.31
1981	2.05	1.96	1.32	4.29
1982	2.12	1.97	1.53	4.72
1983	2.35	2.18	1.84	4.55
1984	2.12	1.91	1.71	4.76
1985	2.45	2.19	1.91	4.53
1986	2.11	1.88	1.59	4.00
1987	2.16	2.00	1.54	3.69
1988	2.17	2.08	1.46	3.96
1989	2.65	2.79	1.87	3.25
1990	2.96	3.22	2.64	2.55
1991	2.72	2.79	2.80	2.04
1992	2.74	2.71	2.88	2.06
1993	2.65	2.53	2.88	1.92
1994	2.84	2.90	2.93	2.15
1995	2.27	2.31	2.36	1.77
1996	2.21	2.25	2.26	1.77
1997	**2.13**	**2.13**	**2.30**	**1.62**
Average	2.15	2.10	2.11	3.30
Standard Deviation	0.45	0.49	0.53	1.00

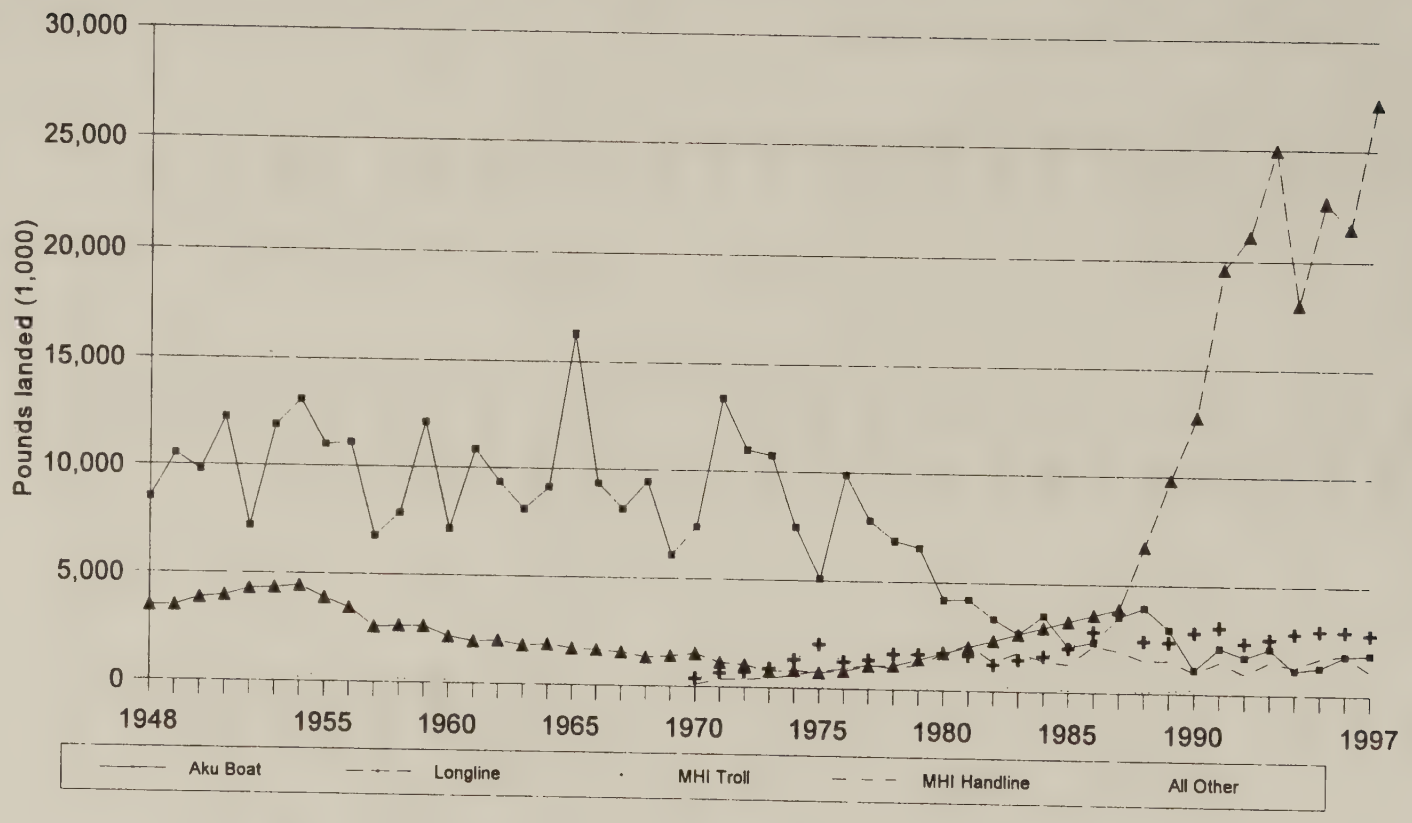
[1] Each years' inflation-adjusted price data must be updated annually.

Data

Data are compiled from Hawaii Division of Aquatic Resources (HDAR) commercial catch reports. Nominal price is calculated as (ex vessel) revenue / pounds sold. Inflation-adjusted price is calculated from the Honolulu consumer price index (CPI) as: (Current year CPI / data year CPI) * data year nominal price. No adjustment is made in this table for product form (e.g., most swordfish prices in HDAR are reported as headed, gilled, and gutted, not raised to whole weights. This increases the reported average billfish price.

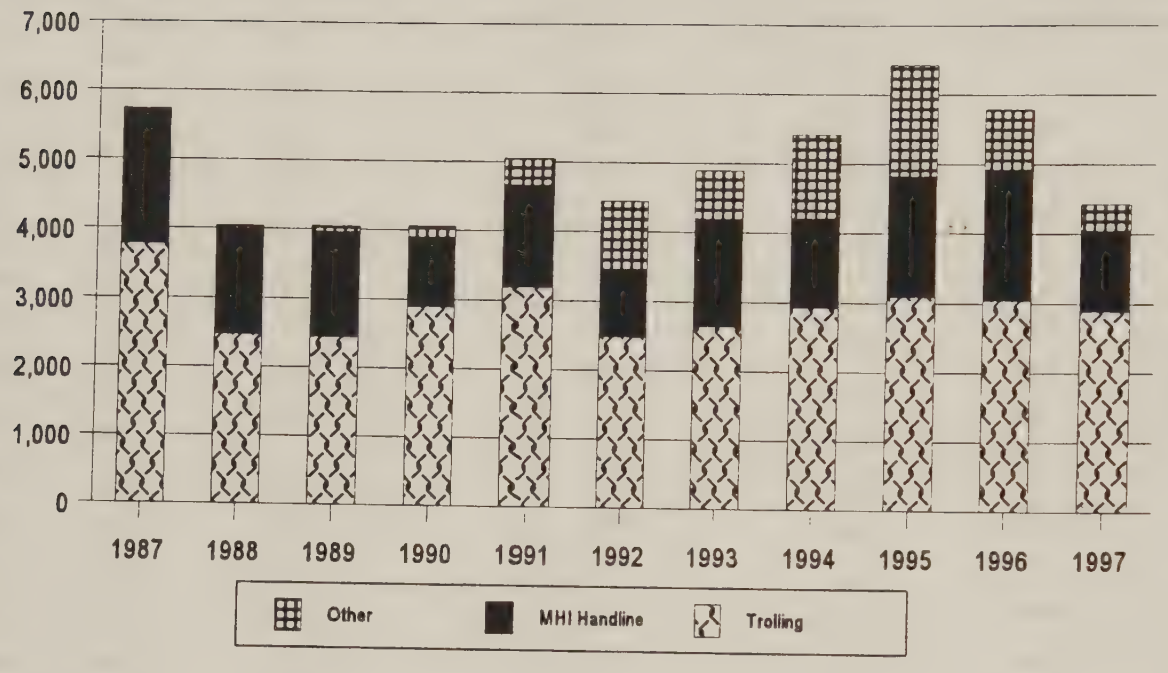
Data source: PPRICE.xls (7/17/98)

Figure 3a. Hawaii commercial pelagic landings by major gear types.



Data source and interpretation follow next figure.

Figure 3b. Troll-Handline-Other Gears Pelagic Landings, 1987-97.



Interpretation: This table attempts to "interpret" the handline and other categories of pelagic landings in Hawaii. Trolling for pelagics has remained steady in terms of landings over the past 10 years. On the other hand, landings identified as main Hawaiian Islands (MHI) handline have fluctuated substantially, while the landings attributed to Other Gears - Other Areas[1] grew in the early 1990s and have declined again.

Comparing landings in 1995 (the largest for Other Gears - Other Areas and near largest for MHI handline) with 1997 is instructive.

In 1995, Other pelagic gear landings were almost 50% non-MHI pelagic handline (Cross Seamount?) and a similar amount identified as Other Gears - Other Areas (distant-water albacore trollers?). The non-MHI pelagic handline landings were predominately yellowfin tuna (587,000 pounds) and bigeye tuna (102,000 pounds). The Other Gears - Other Areas landings were almost entirely albacore (815,000 pounds). Almost all of the Trolling landings were recorded in the MHI.

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[1] Includes NWHI landings by these gear types, distant-water albacore trollers, and Cross Seamount handline when reported separately.

In 1997, the non-MHI handline pelagic landings were simply reported as lower. Almost all of the trolling landings were recorded in the MHI. However, since the data for this module required some extrapolation, if there were a bias in seasonality (more non-MHI handline pelagics caught in the last three months of the year) or in reporting timeliness, then next year's report should clarify the situation. Similarly, there were almost no Other Gears - Other Areas landings (again, primarily albacore). Whether distant-water albacore trollers didn't offload in Honolulu in 1997 or whether the same biases as with the Cross-Seamount handline boats needs to be examined.

Data: Data are compiled from HDAR commercial catch reports using a data summarization program (HEPS.prg) maintained by the Fishery Monitoring and Economics Program of the NMF Honolulu Laboratory.

Gears are categorized in this report as follows:

Trolling:	Gear 6 in HDAR codes
Handline:	Gears 3 (Deepsea handline), 8 (Ika Shibi), 9 (Palu Ahi), and 35 (Drifting/Pelagic handline)
Other:	All remaining gears (except Longline and Aku Boat)

Areas are categorized as follows:

MHI:	HDAR Areas 100-699
Other:	Includes NWHI, the periphery of the MHI (usually outside of one-degree sqaure of the MHI), and all other fishing locations.

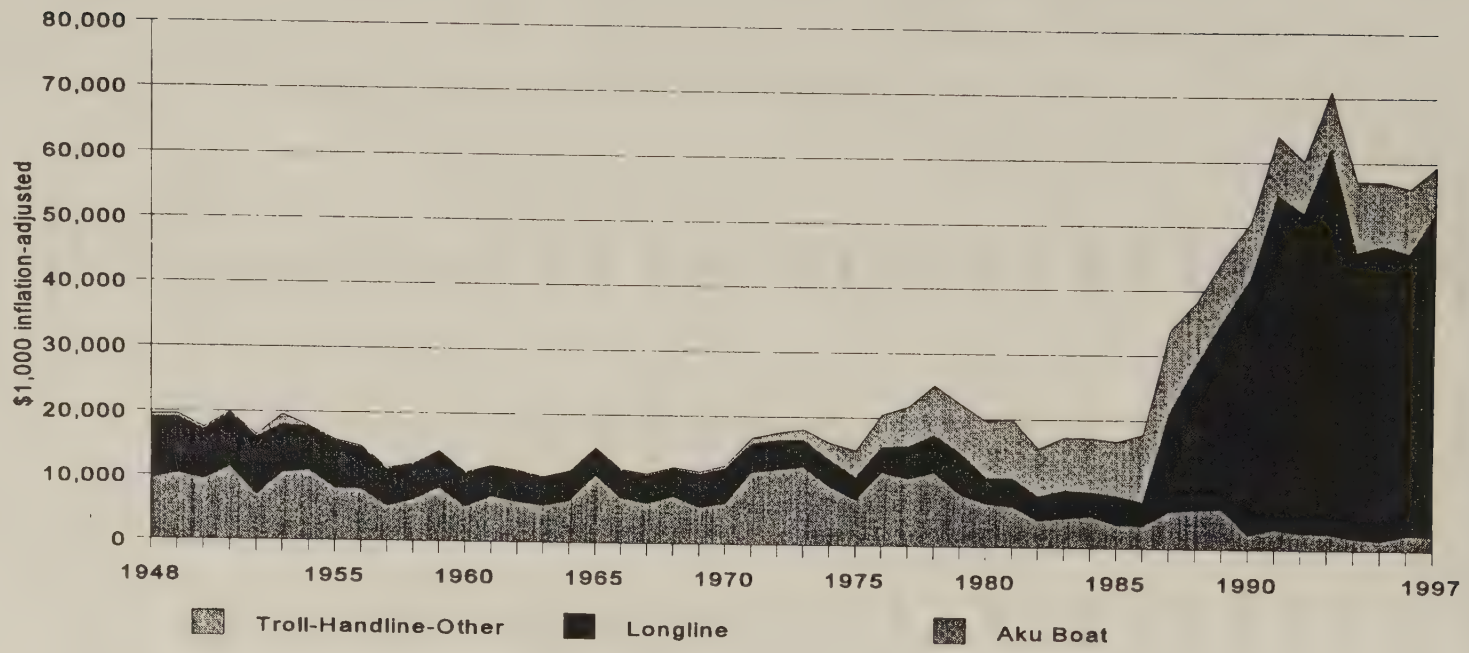
Data Source: P8797N.xls (7/17/98)

Hawaii commercial troll-handline-other gear landings, 1987-1997.

Year	Troll	MHI Handline	Other Pelagic Gears[1]
1987	3,775	1,947	12
1988	2,466	1,537	39
1989	2,436	1,531	82
1990	2,891	1,009	161
1991	3,186	1,490	377
1992	2,481	961	998
1993	2,644	1,533	721
1994	2,921	1,297	1,210
1995	3,088	1,742	1,601
1996	3,044	1,888	860
1997	2,891	1,118	418
Average	2,893	1,459	589
Standard Deviation	393	334	531

[1] Includes NWHI pelagics, distant-water albacore trollers, and Cross Seamount handline when reported separately.

Figure 4. Hawaii commercial fishing revenue*, adjusted for inflation.



Interpretation: On an inflation-adjusted ex-vessel revenue basis, the dominance of the longline fleet beginning in the late 1980s is clearly shown. Approximately 80% of all commercial pelagics revenue comes from the longline fishery, compared to less than 30% in 1980.

Hawaii commercial fishing revenue*, adjusted for inflation, 1948-97.

Year	Aku Boat	Longline	Troll-Handline-Other
1948	9,452	9,453	571
1949	10,330	8,671	615
1950	9,418	7,703	430
1951	11,324	8,183	323
1952	7,026	9,016	400
1953	10,511	7,483	1,653
1954	10,919	6,770	223
1955	8,184	7,311	317
1956	8,070	6,399	325
1957	5,455	5,655	296
1958	6,502	5,389	218
1959	8,380	5,592	174
1960	5,507	5,109	226
1961	7,143	4,567	204
1962	6,282	4,694	221
1963	5,786	4,304	211
1964	6,521	4,497	215
1965	10,519	4,163	211
1966	7,041	4,228	270
1967	6,267	4,312	288
1968	7,391	4,229	301
1969	5,730	5,116	427
Average	7,898	6,038	369
Standard Deviation	1,925	1,747	310

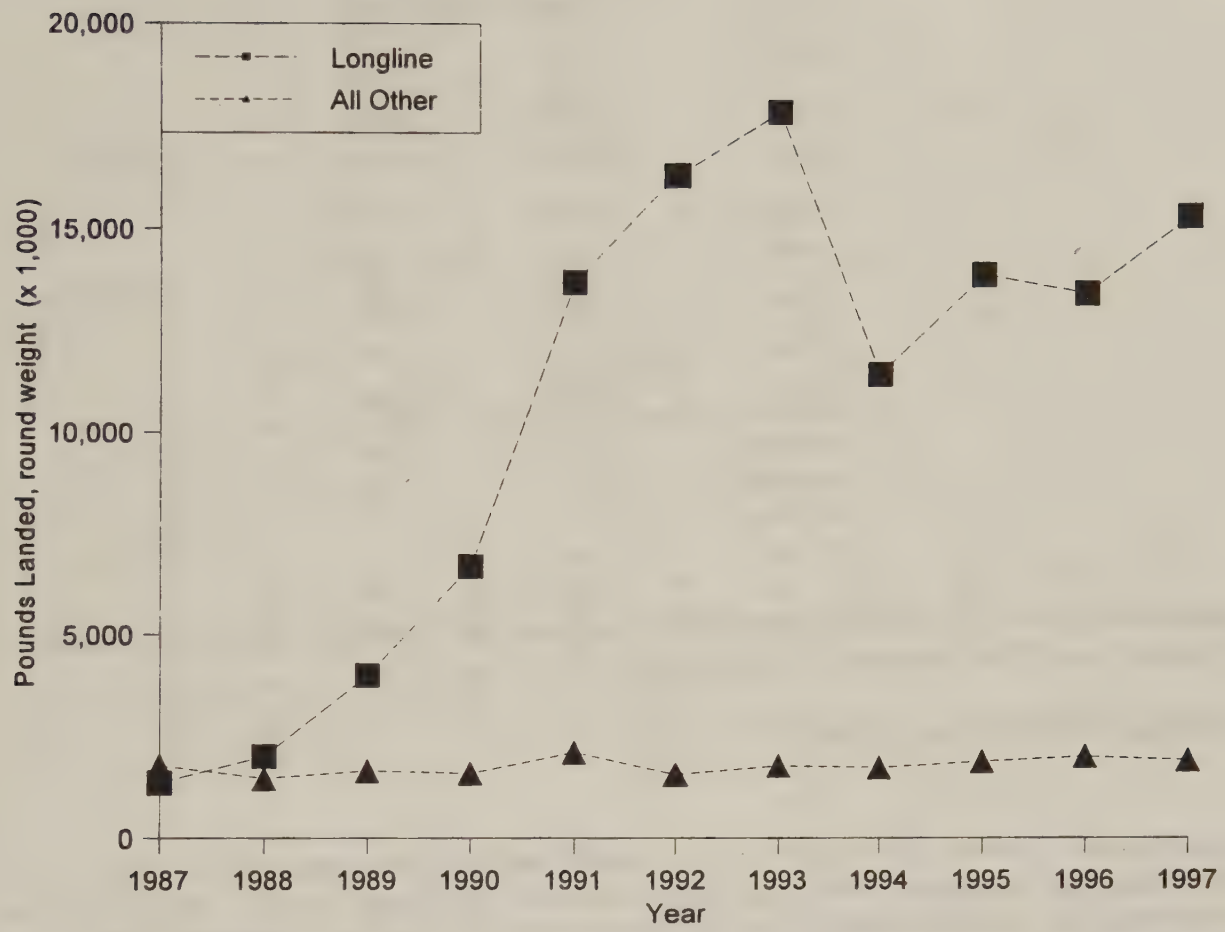
Table continued on next page.

Year	Aku Boat	Longline	Troll-Handline-Other
1970	6,389	5,380	491
1971	11,285	4,484	939
1972	11,705	4,654	1,179
1973	12,168	4,248	1,702
1974	9,192	4,156	2,734
1975	7,176	3,479	4,239
1976	11,457	4,006	5,021
1977	10,517	5,131	6,108
1978	11,538	5,867	7,733
1979	8,194	6,522	7,608
1980	6,818	3,981	8,908
1981	6,378	4,425	9,156
1982	4,238	3,791	7,459
1983	4,621	4,270	8,430
1984	4,944	3,785	8,470
1985	3,721	4,458	8,530
1986	3,591	3,670	10,566
1987	5,792	15,468	12,640
1988	6,062	22,622	9,606
1989	6,260	29,133	9,789
1990	2,400	39,526	8,809
1991	3,197	51,777	9,194
1992	2,725	49,507	8,108
1993	2,643	59,521	8,817
1994	1,960	44,287	10,909
1995	1,616	45,655	9,816
1996	2,442	43,701	9,877
1997	**2,382**	**49,940**	**7,119**
Average	6,112	19,336	7,536
Standard Deviation	3,495	20,111	3,042

Data: Combination of HDAR commercial catch reports for non-longline gears and NMFS estimates for longline.

Data Source: HTOT97a.xls (7/17/98)

Figure 5. Hawaii commercial billfish and other non-tuna PMUS landings by gear type, 1987-97.



Hawaii commercial billfish and other non-tuna PMUS landings by gear type.

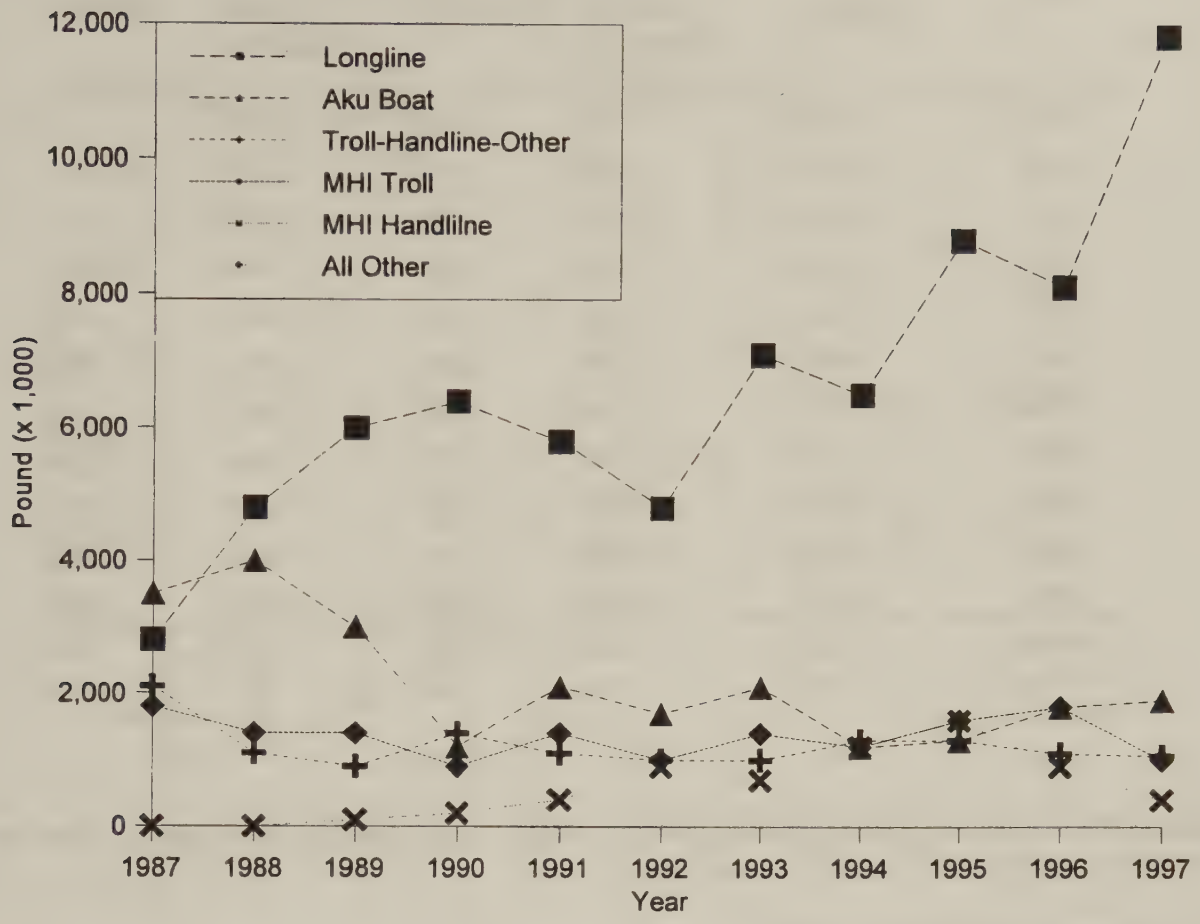
Year	Pounds Landed (x 1,000)	
	Longline	All Other
1987	1,350	1,776
1988	2,000	1,459
1989	4,000	1,648
1990	6,700	1,586
1991	13,700	2,105
1992	16,310	1,558
1993	17,860	1,784
1994	11,460	1,734
1995	13,890	1,882
1996	13,430	2,001
1997	**15,300**	**1,910**
Average	10,545	1,768
Standard Deviation	5,957	197

Data: Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports.

Data Source: P8797N.cal (6/30/98)

Interpretation: Swordfish has risen from 4 % of longline landings of non-tunas in 1987 to 42 % in 1997. In addition, the non-tuna PMUS includes the estimated round weight of pelagic sharks (e.g., blue sharks) which are caught incidentally and processed at-sea only for their fins. This amounted to approximately 30% of non-tuna longline landings in 1997. More information is obtainable from the species tables and from the NMFS annual report on the fishery (Ito, 1998).

Figure 6.Hawaii commercial tuna landings by gear type, 1987-97.



Hawaii commercial tuna landings by gear type.

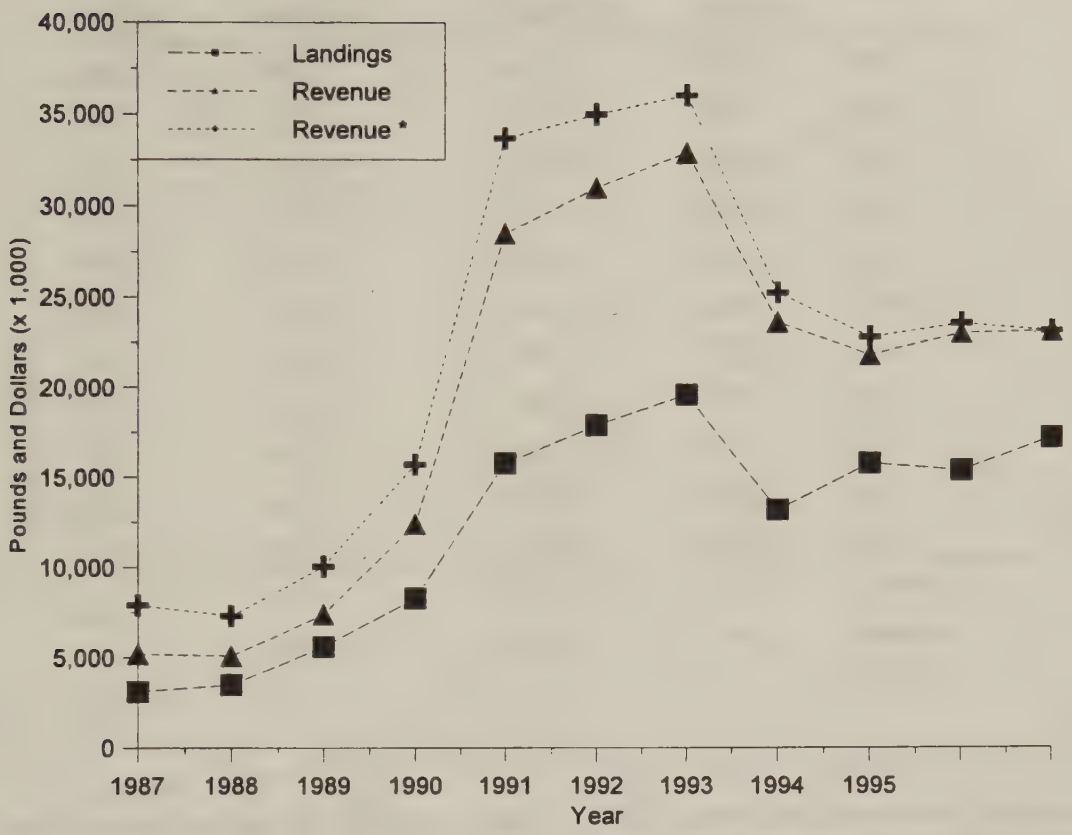
Year	Pounds Landed (x 1,000)				
	Longline	Aku boat (Pole-and-line baitboat)	MHI Troll	MHI Handline	All Other
1987	2,800	3,500	2,100	1,800	0
1988	4,800	4,000	1,100	1,400	0
1989	6,000	3,000	900	1,400	100
1990	6,400	1,200	1,400	900	200
1991	5,800	2,100	1,100	1,400	400
1992	4,800	1,700	1,000	1,000	900
1993	7,100	2,100	1,000	1,400	700
1994	6,500	1,200	1,300	1,200	1,200
1995	8,800	1,300	1,300	1,600	1,600
1996	8,100	1,800	1,100	1,800	900
1997	**11,800**	**1,900**	**1,060**	**1,000**	**400**
Average	6,627	2,164	1,215	1,355	582
Standard Deviation	2,374	943	330	308	525

Data: Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports.

Data Source: P8797N.cal (6/30/98)

Interpretation: Since 1993, longline fishing effort increasingly has focused on tuna as a target species (as described in Ito, 1996). Aku boat landings remained below the recent long-term average but have increased since their nadir in 1994. MHI troll landings are slightly below their long-term average, as are MHI handline. However the extrapolation used for the 1997 data may be distorting these figures, which will be verified in next year's report. The time-series now illustrates the fluctuating importance (or reporting) of all other gears, including NWHI trolling and handline, off-shore handline, and distant-water troll. In 1997, most of the All Other tuna landings were primarily off-shore handline (probably the seamounts): 63,000 pounds of bigeye and 276,000 pounds of yellowfin, compared to 1996: 355,000 pounds of bigeye and 370,000 pounds of yellowfin.

Figure 7. Hawaii billfish & other non-tuna PMUS landings and revenue, 1987-1997.



Species composition of Hawaii commercial billfish landings, 1987-97

Year	Pounds Landed (x 1,000)			
	Swordfish	Blue marlin	Striped marlin	Other billfish
1987	100	700	700	200
1988	100	800	1,200	200
1989	600	1,500	1,400	300
1990	3,400	1,400	1,400	100
1991	9,900	1,500	1,500	500
1992	12,600	1,300	1,100	300
1993	13,100	1,400	1,200	300
1994	7,000	1,500	800	300
1995	6,000	2,000	1,300	500
1996	5,500	1,900	1,000	300
1996	**6,400**	**1,800**	**900**	**400**
Average	5,882	1,436	1,136	309
Standard Deviation	4,647	406	262	122

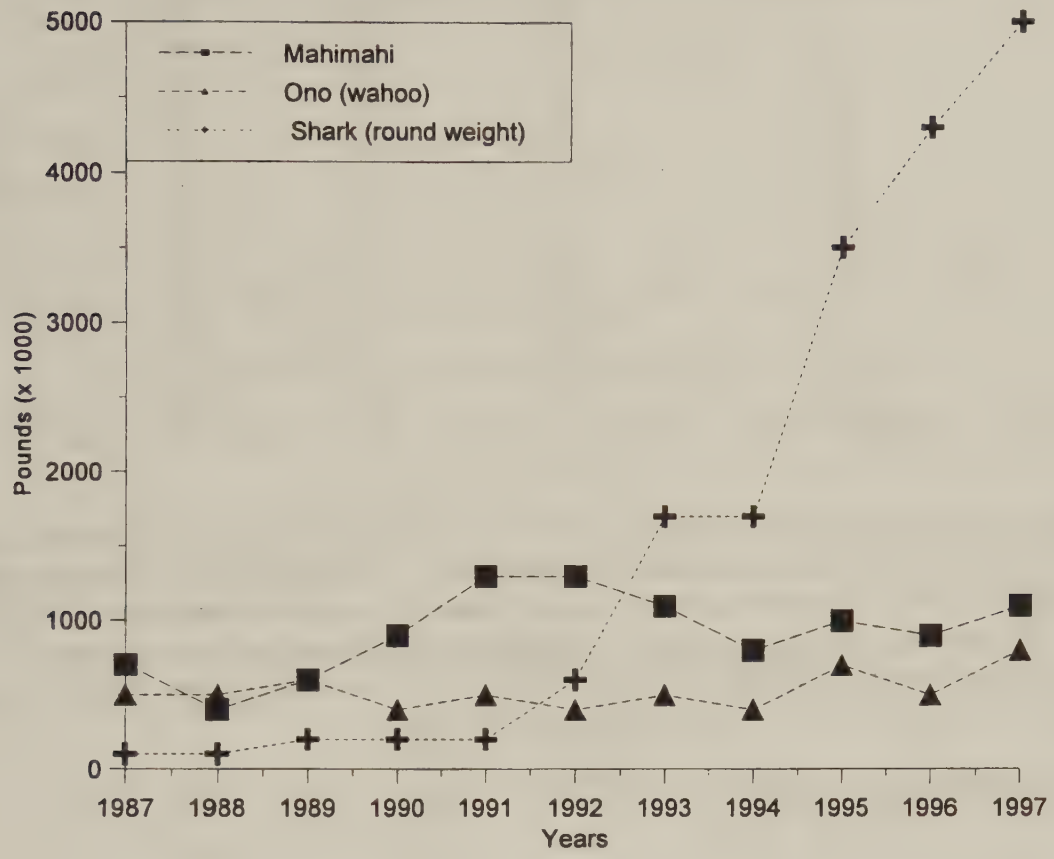
Data: Species summaries for all gears combined are compiled from HDAR and NMFS landings figures. Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports. Data are rounded to the nearest 100,000 pounds.

Data Source: P8797N.xls (6/30/98)

Interpretation: The swordfish component of the longline fishery rose rapidly in the early 1990s, with a significant decline subsequently as longline fishing effort shifted towards tuna. Blue marlin landings were above the long-term average. Other species were within their recent ranges.

Longline landings of blue marlin have increased from 15% of the total in 1987 to 65% of the total in 1995 and 60% in 1997. Troll-handline-other landings have remained relatively constant over the time period.

Figure 9. Hawaii commercial landings -- mahimahi, ono (wahoo), and sharks (whole weight), 1987-1997



Hawaii commercial landings -- mahimahi, ono(wahoo), and sharks.

	Pounds (x 1,000)		
Year	Mahimahi	Ono (Wahoo)	Sharks[1]
1987	700	500	100
1988	400	500	100
1989	600	600	200
1990	900	400	200
1991	1,300	500	200
1992	1,100	400	600
1993	800	500	1,700
1994	1,000	400	1,700
1995	1,000	700	3,500
1996	900	500	4,300
1997	**1,100**	**800**	**5,000**
Average	891	527	1,600
Standard Deviation	255	127	1,840

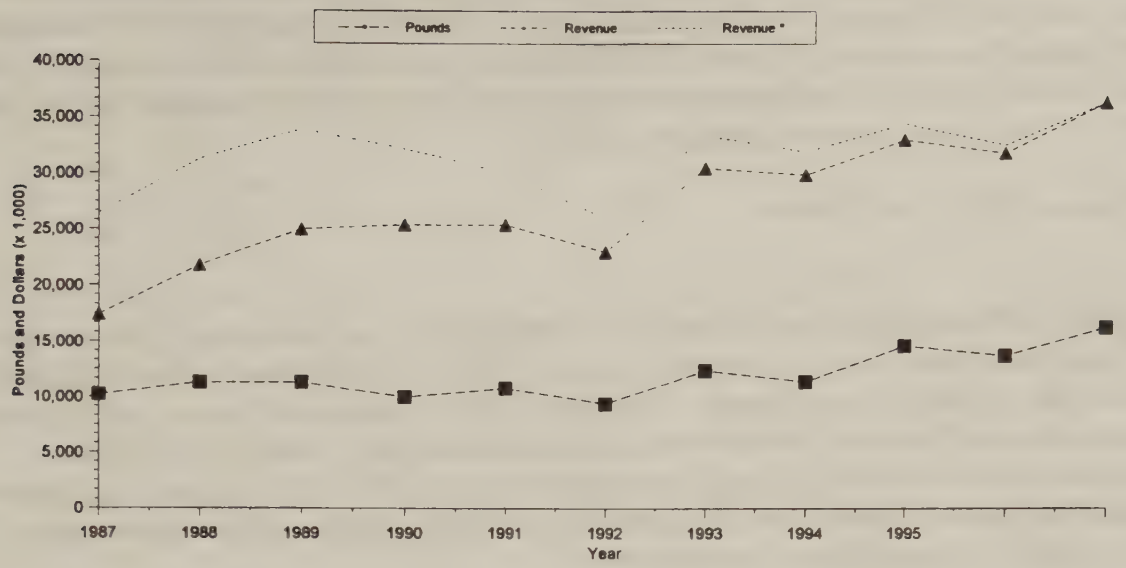
Data: Species summaries for all gears combined are compiled from HDAR and NMFS landings figures. Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports. Data are rounded to the nearest 100,000 pounds. Shark landings represent reported weights for troll-handline-other gears and NMFS estimates of round or whole weights for longline-caught shark, including sharks "finned" (where only the fins are retained and the carcasses are discarded at sea).

Data Source: P8797N.cal (6/30/98)

Interpretation: Mahimahi and ono landings are within their recent ranges. In 1997, 84,000 sharks were caught, of which 48,000 were kept: only 775 sharks were kept as *whole* shark product and the remainder were processed as a finned product.

[1] Shark whole-weight estimate. Most shark is landed as a finned product.

Figure 10. Hawaii tuna landings and revenue, 1987-97.



Hawaii tuna landings and revenue, 1987-97.

Year	Pounds Landed (x 1,000)	Nominal Revenue x $1,000	Inflation-adjusted Revenue x $1,000	HCPI
1987	10,200	17,400	26,423	116
1988	11,300	21,800	31,244	123
1989	11,300	25,000	33,924	130
1990	10,000	25,400	32,184	139
1991	10,800	25,400	30,023	149
1992	9,400	23,000	25,965	156
1993	12,400	30,500	33,404	161
1994	11,400	29,900	31,951	165
1995	14,600	33,000	34,489	168
1996	13,700	31,800	32,540	172
1997	**16,200**	**36,300**	**36,300**	**176**
Average	11,936	27,227	31,677	
Standard Deviation	2,102	5,567	3,187	

Data: Commercial landings and ex vessel revenue for all gears combined are compiled from HDAR and NMFS figures. Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports. Data are rounded to the nearest 100,000 pounds. Inflation-adjusted revenue bases previous year's revenues on the current year (1997) Honolulu consumer price index (HCPI).

Data Source: P8797n.xls (6/30/98)

Interpretation: Tuna landings in the Hawaii commercial fishery are the second highest on record (1965) and the highest since the tuna cannery closed (1984).[2] Nominal and inflation-adjusted ex vessel revenue are also at record levels. Troll-handline-other landings of tuna are below average for the recent period; however, we are worried that the extrapolation used to account for incomplete reports for 1997 may have distorted these figures. Aku boat (pole-and-line skipjack tuna) landings remain depressed but there has been significant growth in the past two years as new investment is beginning to enter that sector.

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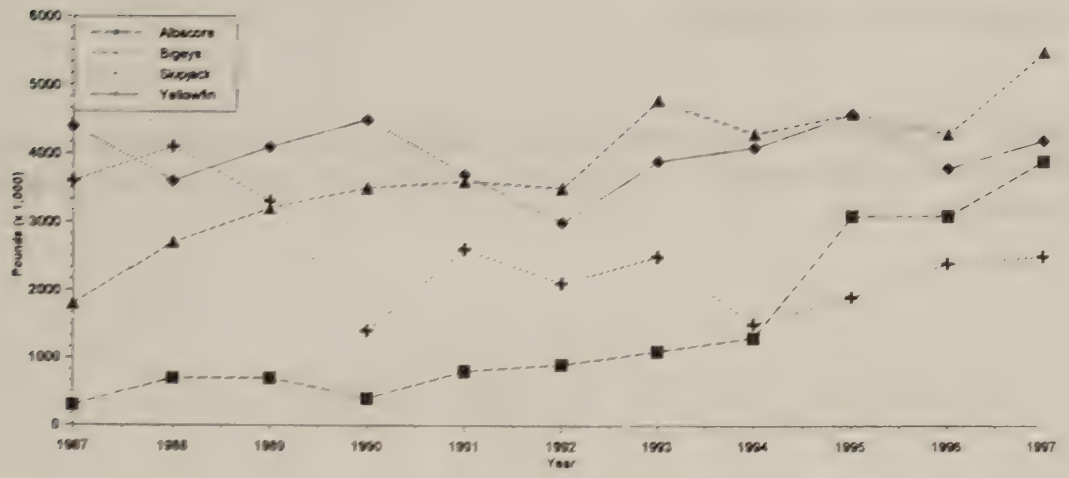
[2] Total tuna landings were 14,700,000 pounds (sold) in 1970, of which over half was from the pole-and-line aku boat fleet. The record landings were in 1965 (16.3 million pounds).

Figure 11. Species composition of Hawaii commercial tuna landings, 1987-97.



Species composition of Hawaii commercial tuna landings, 1987-97.

Year	Pounds Landed (x 1,000)			
	Albacore	Bigeye	Skipjack (aku)	Yellowfin
1987	300	1,800	3,600	4,400
1988	700	2,700	4,100	3,600
1989	700	3,200	3,300	4,100
1990	400	3,500	1,400	4,500
1991	800	3,600	2,600	3,700
1992	900	3,500	2,100	3,000
1993	1,100	4,800	2,500	3,900
1994	1,300	4,300	1,500	4,100
1995	3,200	4,700	1,700	5,000
1996	3,100	4,300	2,400	3,800
1997	**3,900**	**5,500**	**2,500**	**4,200**
Average	1,491	3,809	2,518	4,027
Standard Deviation	1,272	1,048	862	526

Data: Species summaries for all gears combined are compiled from HDAR and NMFS landings figures. Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports. Data are rounded to the nearest 100,000 pounds.

Data Source: P8797N.xls (6/30/98)

Interpretation: Albacore and bigeye were at record landings while both yellowfin and skipjack (aku) were at their recent averages. Longline landings of albacore have increased dramatically over the past four years.

Figure 12. Hawaii longline vessel activity, 1987-97.

Hawaii longline vessel activity, 1987-97.

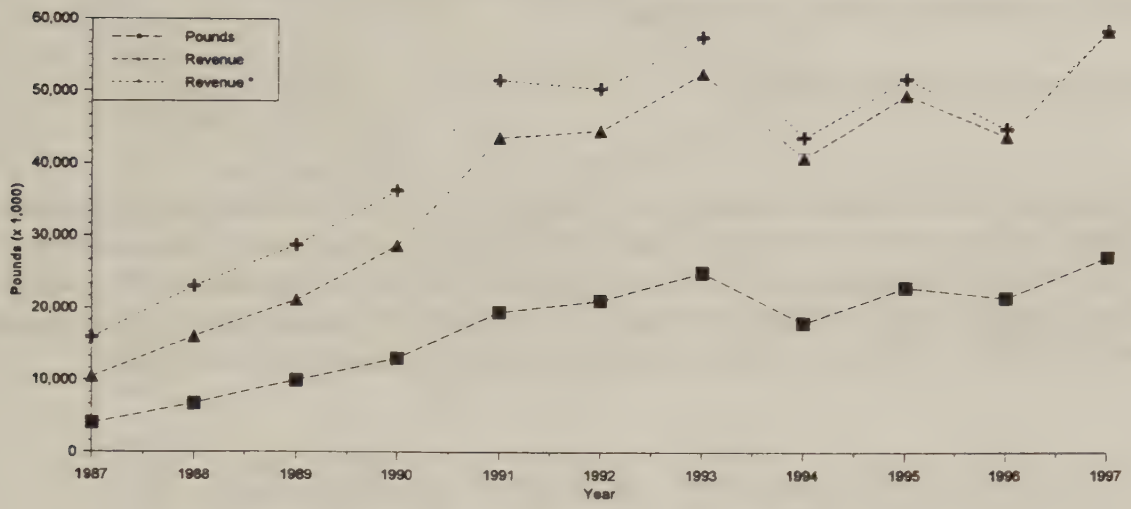
Year	Active Vessels	Trips
1987	50	627
1988	80	923
1989	138	1,546
1990	140	1,664
1991	141	1,670
1992	123	1,265
1993	122	1,192
1994	125	1,106
1995	110	1,125
1996	103	1,100
1997	**105**	**1,122**
Average	103	1,101
Standard Deviation	33	338

Data: Longline fishing effort data are compiled from Federal logbooks collected by the Fishery Monitoring & Economics Program of the NMFS Honolulu Laboratory for the year 1991-present, and by shoreside monitoring by FMEP in earlier years.

Data source: LL96a.cal (4/22/97)

Interpretation: Although the number of active longline vessels has subsided in recent years, they remain above the average for participation since the mid-1980s. Longline trip activity decreased slightly in 1996 and remains substantially below the 1990-91 peak when limited entry into the fishery was introduced.

Figure 13a. Hawaii longline landings and revenue, 1987-97.



Hawaii longline landings and revenue, 1987-97.

Year	Pounds (x 1,000)	Nominal Revenue ($1,000)	Adjusted Revenue ($1,000)	Honolulu Consumer Price Index
1987	4,100	10,500	15,945	116
1988	6,800	16,100	23,075	123
1989	10,000	21,200	28,768	130
1990	13,100	28,700	36,366	139
1991	19,500	43,700	51,653	149
1992	21,100	44,700	50,463	156
1993	25,000	52,600	57,608	161
1994	18,000	40,900	43,706	165
1995	22,900	49,600	51,838	168
1996	21,500	43,900	44,921	172
1997	**27,100**	**58,400**	**58,400**	**176**
Average	17,191	37,300	42,068	
Standard Deviation	7,612	15,760	14,246	

Data: Longline landings and ex vessel revenue estimates are compiled by the NMFS Honolulu Laboratory. They represent weight estimates using Federal logbooks (since 1991) and market monitoring average weight per fish and average price per pound. From 1987-1990, estimates rely on NMFS shoreside and market monitoring.

Data Source: P8797N.xls (6/30/98)

Interpretation: Hawaii longline landings grew substantially in 1997 to a new peak after having been stable for the previous two years. Most of the effort in the past several years has been directed at tunas, with bigeye and albacore providing the largest volume. However swordfish remains the largest single component of landed product. Bigeye provides the highest ex-vessel revenue by far ($20.8 million), while swordfish provides the second ($15.4 million).

Figure 13b. Hawaii longline landings -- billfish (including swordfish), 1987-97.

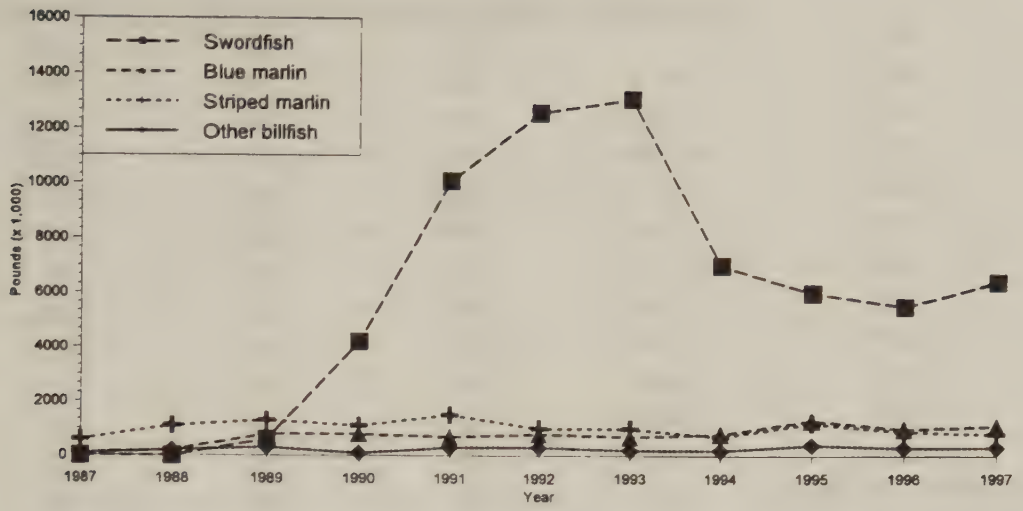
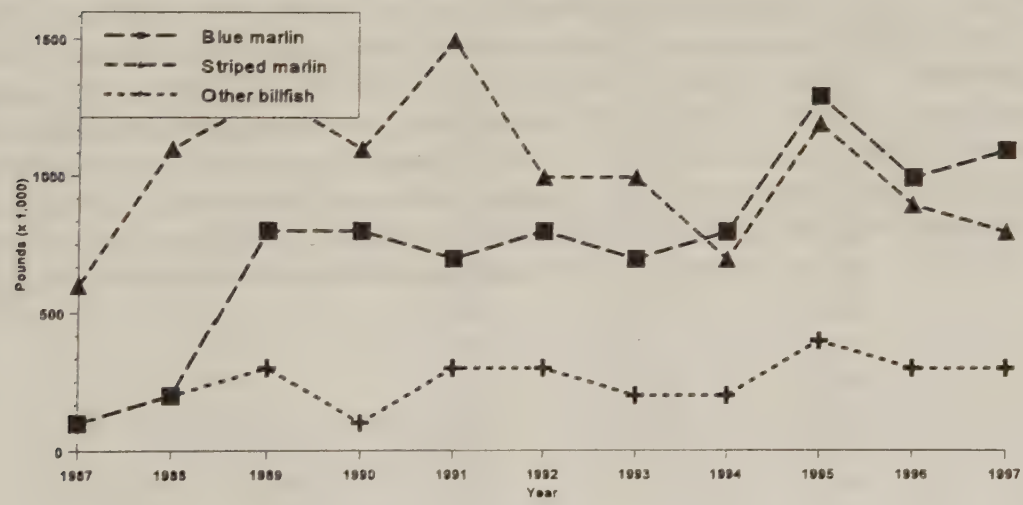


Figure 13c. Hawaii longline landings - marlins & other billfish, 1987-97.



Hawaii longline landings -- billfish (including swordfish), 1987-97.

	Pounds Landed (x 1,000)			
	Swordfish	Blue marlin	Striped marlin	Other billfish
1987	0	100	600	100
1988	0	200	1,100	200
1989	600	800	1,300	300
1990	4,200	800	1,100	100
1991	10,100	700	1,500	300
1992	12,600	800	1,000	300
1993	13,100	700	1,000	200
1994	7,000	800	700	200
1995	6,000	1,300	1,200	400
1996	5,500	1,000	900	300
1997	**6,400**	**1,100**	**800**	**300**
Average	5,955	755	1,018	245
Standard Deviation	4,654	350	264	93

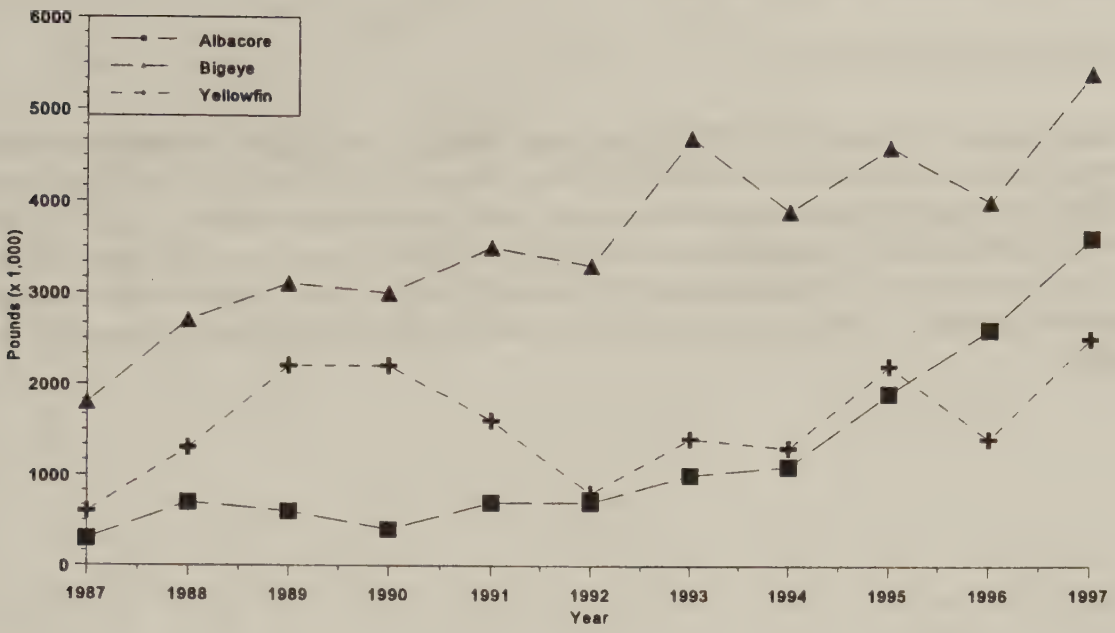
Data: Data are compiled from Federal logbooks and market monitoring information by NMFS Honolulu Laboratory and HDAR staff.

Data source: P8797N.xls (6/30/98)

Interpretation: Total billfish landings (including swordfish) have been relatively stable the last few years. However landings of striped marlin declined in 1996 and 1997 to below its 10-year average. The dramatic decline in swordfish landings in 1994 represented a change in vessel targeting practices.[1] Figure 15 shows the decline in swordfish-directed trips and the stability in accompanying catch per unit effort (CPUE). Nonetheless, swordfish remains the largest single species landed by the Hawaii longline fleet in terms of pounds landed, although the ex vessel revenue of bigeye tuna exceeds swordfish revenue. Most swordfish continues to be exported to the U.S. mainland. All other species are within their recent ranges and above their long-term averages. Swordfish landings were $15.4 million ex-vessel, while the other marlins were $2.5 million.

[1] See the 1995 annual report for a full discussion of the 1994 swordfish CPUE.

Figure 14. Hawaii longline landings -- tunas, 1987-97.



Hawaii longline landings -- tunas, 1987-97.

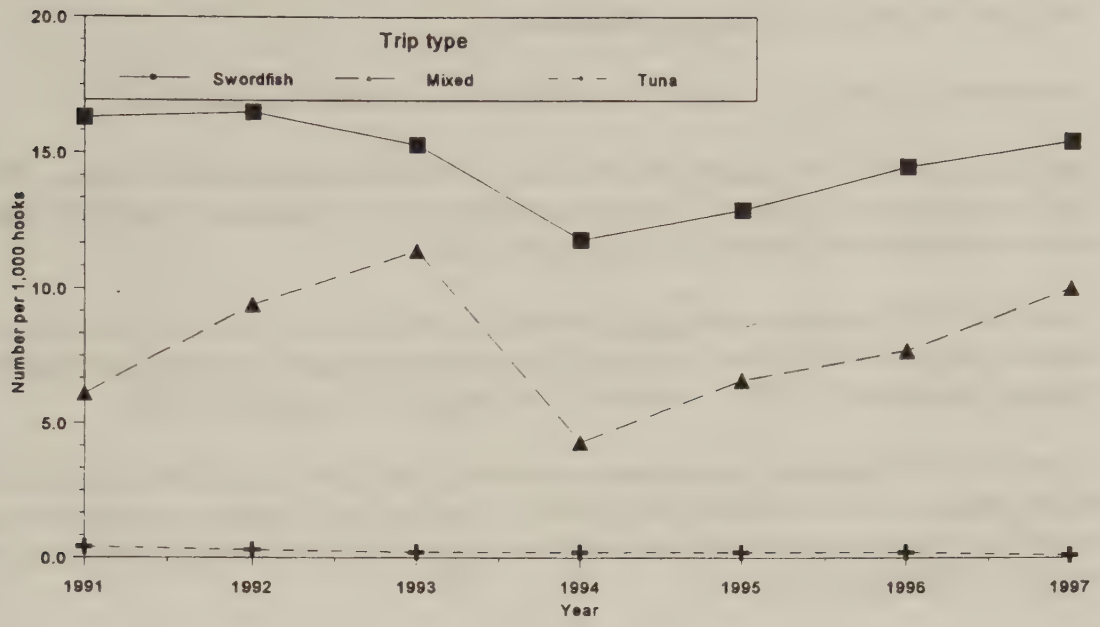
	Pounds Landed (x 1,000)		
Year	Albacore	Bigeye	Yellowfin
1987	300	1,800	600
1988	700	2,700	1,300
1989	600	3,100	2,200
1990	400	3,000	2,200
1991	700	3,500	1,600
1992	700	3,300	800
1993	1,000	4,700	1,400
1994	1,100	3,900	1,300
1995	1,900	4,600	2,200
1996	2,600	4,000	1,400
1997	**3,600**	**5,400**	**2,500**
Average	1,330	3,820	1,690
Standard Deviation	1,039	1,022	616

Data: Data are compiled from Federal logbooks and market monitoring information by NMFS Honolulu Laboratory and HDAR staff.

Source:P8797N.xls (6/30/98)

Interpretation: All tuna species show increasing landings over the past four years as targeting towards tunas has returned to historical patterns, although 1996 was a relatively low year for yellowfin tuna (which shows more interannual variation than other species). Bigeye landings were at a record level, while albacore has shown the largest increase over the past five years, evidently reflecting its increased availability or catchability. Some longline trips now target albacore (despite its relatively low price per pound). Longline tuna landings were $35 million ex vessel.

Figure 15. Hawaii longline catch rates -- swordfish catch by trip type, 1991-97.



Swordfish CPUE by longline trip type, 1987-97

Year	Swordfish CPUE (number caught per 1,000 hooks)		
	Swordfish trips	Mixed trips	Tuna trips
1991	16.3	6.1	0.4
1992	16.5	9.4	0.3
1993	15.3	11.4	0.2
1994	11.8	4.3	0.2
1995	12.9	6.6	0.2
1996	14.5	7.7	0.2
1997	**15.4**	**10.0**	**0.1**
Average	14.7	7.9	0.2
Standard Deviation	1.7	2.5	0.1

Data: Longline catch rates are compiled from Federal logbooks. CPUE is *Number caught* per 1,000 hooks set. Trips are categorized by longline captains (or by NMFS staff in the absence of a longline captain) as targeting Swordfish, Tuna or Mixed (meaning either switching of target during the trip or the absence of an explicit target).

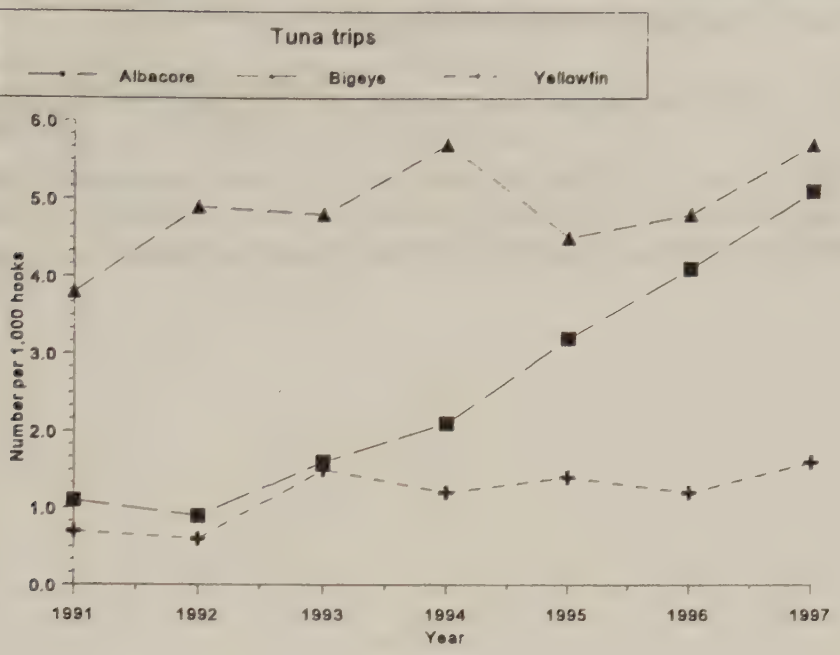
Data source: LL96trip.cal (4/22/97) updated by Ito, 1998 preliminary data.

Interpretation: Although *aggregate* swordfish CPUE has fallen consistently since 1993, this graph makes clear that there is a tremendous difference between aggregate CPUE (which does not take into account targeting), and trip-type CPUE.

Swordfish CPUE on trips which target swordfish declined from 1992 (the year after the Federal logbook program was initiated and shortly after the inception of the swordfish fishery in Hawaii), dipping dramatically in 1994. Swordfish CPUE has since largely recovered.

Mixed trip CPUE showed a much steeper decline in 1994, but a similar recovery. This may reflect changes in Mixed trip targeting behavior from techniques which would catch more swordfish to techniques which would catch more tuna. The 1995 annual report contained an analysis of these trends.

Figure 16. Hawaii longline catch rates -- major tuna species by tuna trips, 1991-97.



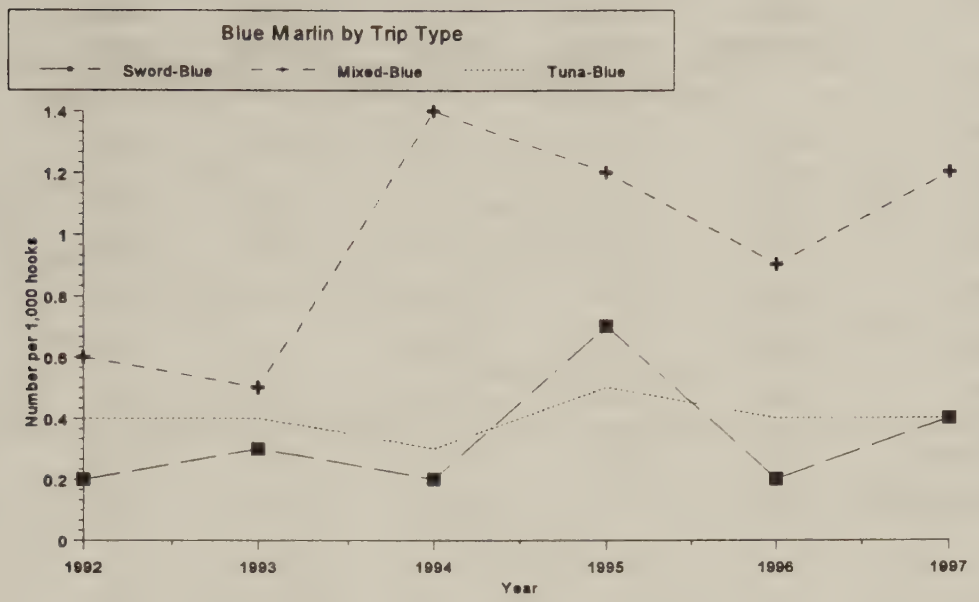
	Tuna-trip CPUEs (number caught per 1,000 hooks)		
Year	**Albacore**	**Bigeye**	**Yellowfin**
1991	1.1	3.8	0.7
1992	0.9	4.9	0.6
1993	1.6	4.8	1.5
1994	2.1	5.7	1.2
1995	3.2	4.5	1.4
1996	4.1	4.8	1.2
1997	**5.1**	**5.7**	**1.2**
Average	2.6	4.9	1.1
Standard Deviation	1.6	0.7	0.4

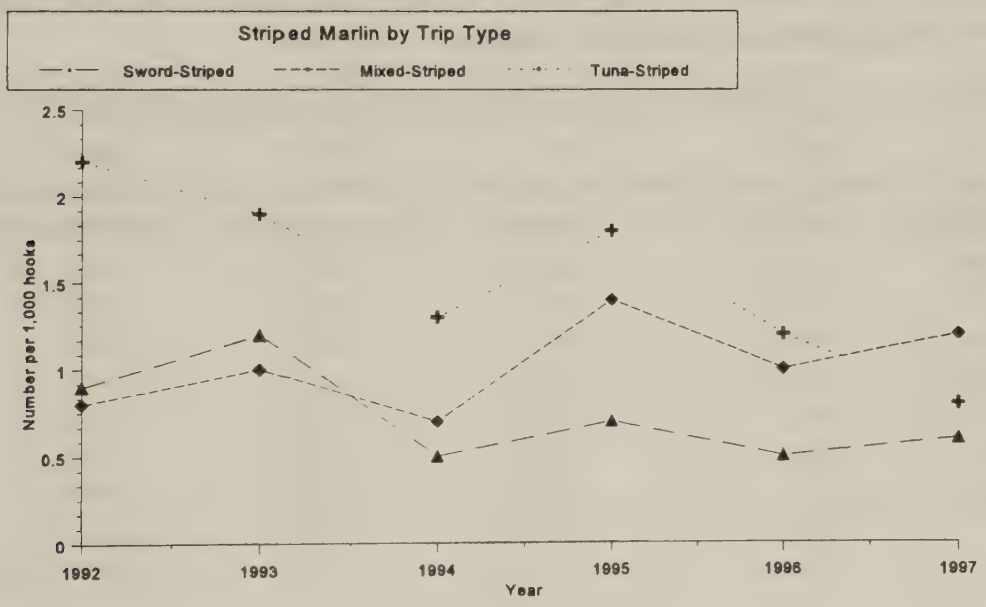
Data: Longline catch rates are compiled from Federal logbooks. CPUE is *Number caught* per 1,000 hooks set. Trips are categorized by longline captains (or by NMFS staff in the absence of a longline captain) as targeting Swordfish, Tuna or Mixed (meaning either switching of target during the trip or the absence of an explicit target).

Data source: LL96trip.cal (4/22/97) updated by Ito, 1998 using preliminary data.

Interpretation: Tuna-trips provide the most realistic view of tuna species catch rates (CPUEs). Albacore is probably more targeted in 1996 and 1997 than previous years, but it appears to be more abundant as well. Bigeye and yellowfin catch rates are within their recent norms.

Figure 17. Hawaii longline catch rates -- blue & striped marlin by trip type, 1991-97.





Marlin CPUEs
(number caught per 1,000 hooks)

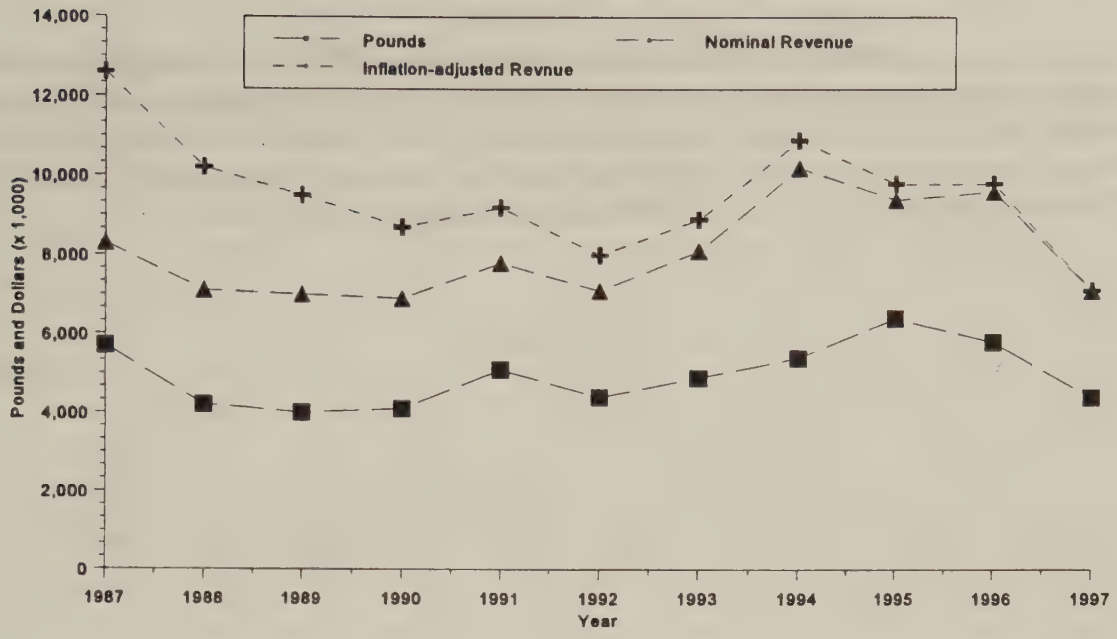
	Swordfish Trips		Mixed Trips		Tuna Trips	
Year	**Blue marlin**	**Striped marlin**	**Blue marlin**	**Striped marlin**	**Blue marlin**	**Striped marlin**
1991	poor species identification precluded quantification in 1991					
1992	0.2	0.9	0.6	0.8	0.4	2.2
1993	0.3	1.2	0.5	1.0	0.4	1.9
1994	0.2	0.5	1.4	0.7	0.3	1.3
1995	0.7	0.7	1.2	1.4	0.5	1.8
1996	0.0	0.5	0.9	1.0	0.4	1.2
1997	**0.4**	**0.6**	**1.2**	**1.2**	**0.4**	**0.8**
Average	0.3	0.7	0.9	1.0	0.4	1.5
Standard Deviation	0.2	0.3	0.3	0.3	0.1	0.5

Data: Longline catch rates are compiled from Federal logbooks. CPUE is *Number caught* per 1,000 hooks set. Trips are categorized by longline captains (or by NMFS staff in the absence of a longline captain) as targeting Swordfish, Tuna or Mixed (meaning either switching of target during the trip or the absence of an explicit target).

Data source: LL96trip.cal (4/22/97) updated by Ito, 1998 using preliminary data.

Interpretation: Blue and striped marlin are caught on all three trip types. Blue marlin catch rates in 1997 were above average for all three trip types and above average for striped marlin on mixed trips.

Figure 18. Hawaii troll, handline, and other gear types – landings and revenue (all pelagic species), 1987-97.



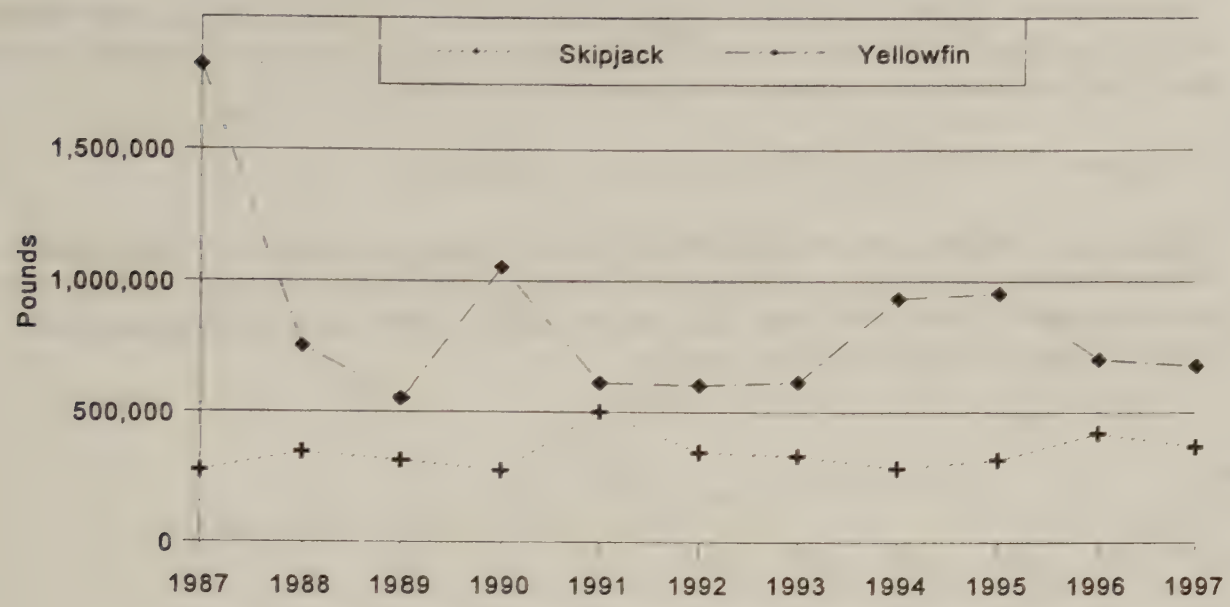
Year	Pounds (x 1,000)	Nominal Revenue ($1,000)	Adjusted Revenue ($1,000)	HCPI
1987	5,700	8,300	12,600	115.90
1988	4,200	7,100	10,200	122.80
1989	4,000	7,000	9,500	129.70
1990	4,100	6,900	8,700	138.90
1991	5,100	7,800	9,200	148.90
1992	4,400	7,100	8,000	155.90
1993	4,900	8,100	8,900	160.70
1994	5,400	10,200	10,900	164.70
1995	6,400	9,400	9,800	168.40
1996	5,800	9,600	9,800	172.10
1997	**4,400**	**7,100**	**7,100**	**176.00**
Average	4,945	8,055	9,518	
Standard Deviation	800	1,188	1,461	

Data: Data are compiled from HDAR commercial catch reports.

Data source: P8797N.xls (6/30/98)

Interpretation: Landings and revenue were both lower for 1997 for the combined troll-handline fishery, including pelagics caught by miscellaneous other gears (including distant-water albacore trollers off-loading in Honolulu in some years, e.g., 1995). However this may reflect problem in extrapolating incomplete data. In addition, almost no landings were recorded by distant water albacore trollers in 1997 (although port-calls did appear to be being made).

Figure 19. Main Hawaiian Islands troll landings – major species, 1987-97.



MHI Troll tuna landings, 1987-97.

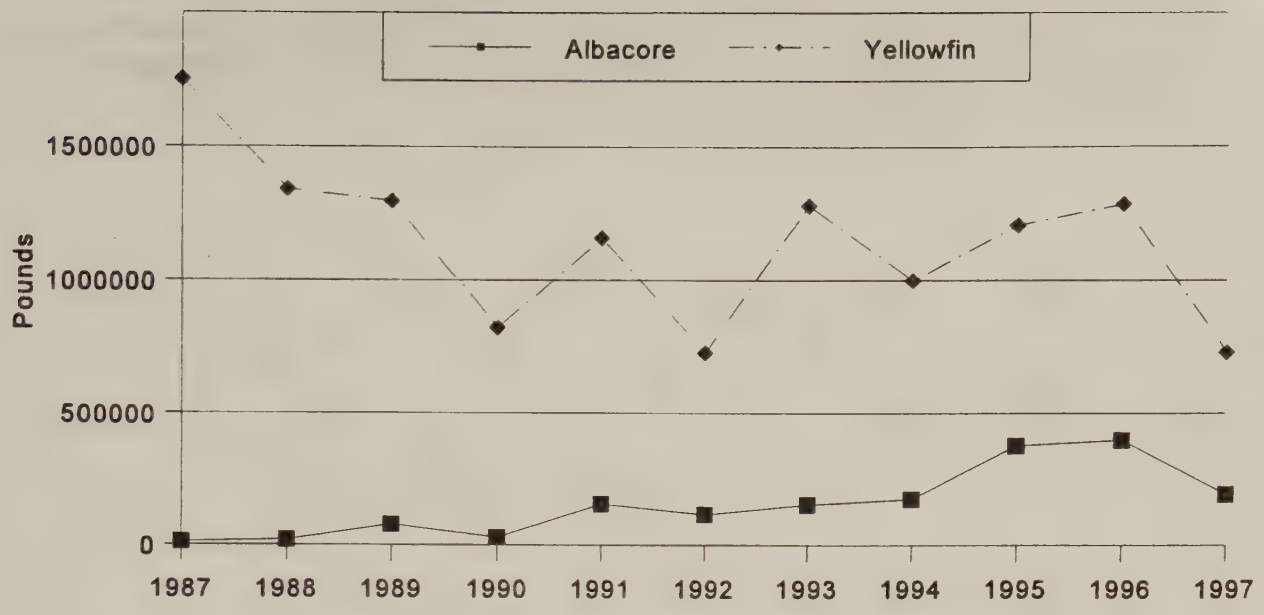
	Pounds landed					
	Albacore	Bigeye	Skipjack	Yellowfin	Other Tuna	Total
1987	1,326	11,236	275,259	1,820,419	19,025	2,127,265
1988	538	9,628	345,783	751,913	15,806	1,123,668
1989	1,172	10,739	313,502	551,068	14,242	890,723
1990	657	15,120	273,715	1,053,467	17,637	1,360,596
1991	1,968	10,615	500,799	611,872	13,621	1,138,875
1992	3,364	9,109	344,446	602,416	16,262	975,597
1993	2,783	3,997	330,705	614,022	10,813	962,320
1994	21,420	5,883	283,047	934,073	19,066	1,263,489
1995	9,617	9,501	317,261	953,699	10,724	1,300,802
1996	5,456	4,292	419,630	701,905	6,517	1,137,800
1997	**5,692**	**6,765**	**367,556**	**677,061**	**6,356**	**1,063,430**
Average	4,908	8,808	342,882	842,901	13,643	1,213,142
Standard Deviation	6,126	3,320	67,862	363,990	4,546	336,524

Data: Data compiled by NMFS staff from HDAR commercial catch reports (data for 1997 are extrapolated from preliminary reports). These data reflect only trolling gear codes and main Hawaiian islands locations. Some off-shore seamounts (e.g., Cross) are excluded, as are distant-water albacore landings. However some off-shore seamounts (e.g., Jagger) are included, based on the HDAR area code determinations (area codes less than 1000).

Data source: P8797N.xls (6/30/98) imported from GASyr.dbf

Interpretation: Skipjack and yellowfin are the primary tuna species landed by trolling vessels. Skipjack landings were right at their long-term average in 1997, while yellowfin landings have been below average for the last two years. The albacore "spike" in 1994 was probably distant-water albacore trollers with mis-identified locations.

Figure 20. Main Hawaiian Islands handline landings (excluding distant seamounts) -- major species, 1987-97



MHI Handline
Pounds Landed

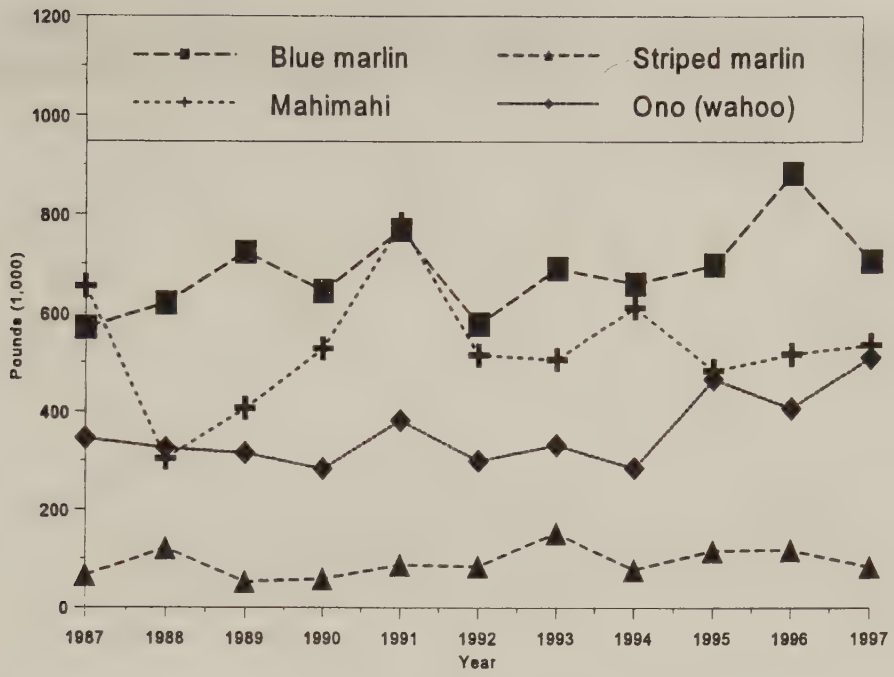
	Albacore	Bigeye	Skipjack	Yellowfin	Other Tuna	Total Tuna
1987	12,145	6,340	24,911	1,750,300	4,995	1,798,691
1988	19,202	27,800	30,533	1,341,367	9,186	1,428,088
1989	77,128	18,664	19,729	1,297,144	10,719	1,423,384
1990	28,725	42,208	26,499	821,890	6,483	925,805
1991	156,139	44,481	18,566	1,158,311	5,995	1,383,492
1992	115,335	18,369	20,779	728,192	6,802	889,477
1993	153,849	2,304	13,487	1,280,160	4,908	1,454,708
1994	174,588	9,737	20,975	999,275	3,495	1,208,070
1995	378,055	32,866	17,235	1,207,164	6,249	1,641,569
1996	398,808	11,250	69,508	1,284,212	3,918	1,767,696
1997	**193,430**	**55,672**	**49,231**	**729,958**	**2,851**	**1,031,142**
Average	155,219	24,517	28,314	1,145,270	5,964	1,359,284
Standard Deviation	131,716	17,473	16,662	306,824	2,368	315,795

Data: Data compiled by NMFS staff from HDAR commercial catch reports (data for 1997 are extrapolated from preliminary reports). These data reflect the various handline gear codes in the State data, for fishing within the main Hawaiian Islands. The more distant off-shore seamounts (e.g., Cross) are excluded. However other off-shore seamounts (e.g., Jagger) are included, based on the HDAR area code determinations (area codes less than 1000).

Data source: P8797N.xls (6/30/98) imported from GASyr.dbf

Interpretation: MHI handline landings in 1997 were down from recent peaks for albacore and yellowfin tuna (the mainstay of the fishery). However it is possible that biases in reporting may have generated inaccurate extrapolation from incomplete data in 1997. This will need to be investigated once complete records are available.

Figure 21. Hawaii commercial troll and handline landings -- non-tuna PPMUS, 1987-97.



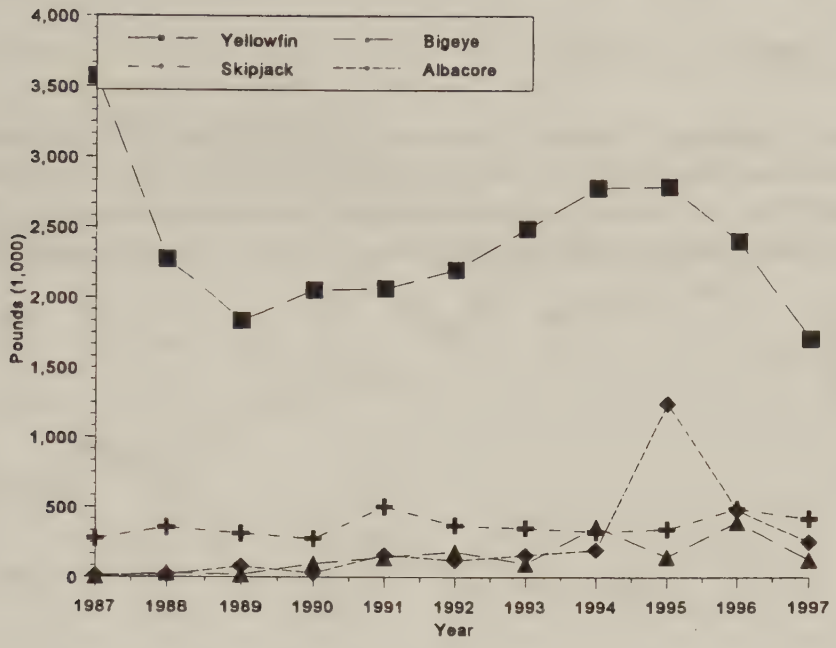
Year	Pounds Landed (x 1,000)			
	Blue marlin	Striped	Mahimahi	Ono(wahoo)
1987	571	66	655	346
1988	621	122	304	326
1989	724	53	407	316
1990	645	59	529	284
1991	769	88	781	383
1992	578	85	516	300
1993	691	153	507	333
1994	660	78	612	286
1995	699	117	485	468
1996	884	119	518	408
1997	**706**	**84**	**537**	**511**
Average	686	93	532	360
Standard Deviation	89	31	124	75

Data: Data compiled by NMFS staff from HDAR commercial catch reports (pounds landed).

Data source: P8797N.xls (6/30/98)

Interpretation: Landings for all non-tuna species are within their recent ranges for the combined troll-handline fishery, except for ono (wahoo) which was above the long-term average for the past three years.

Figure 22. Hawaii commercial troll and handline landings -- tunas, 1987-97.



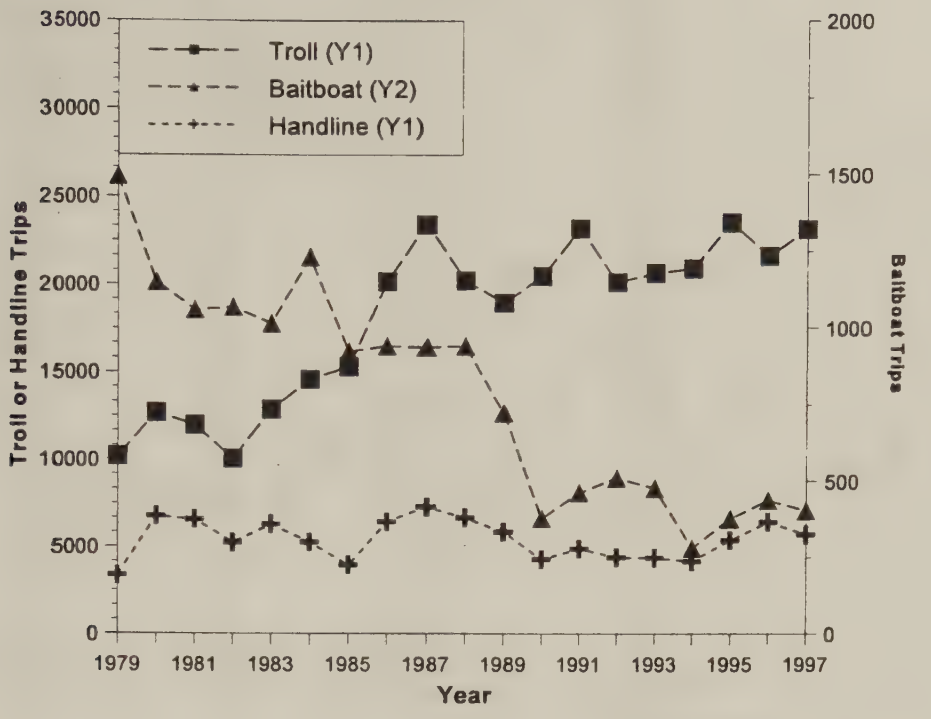
Year	Pounds Landed (x 1,000)			
	Albacore	Bigeye	Skipjack	Yellowfin
1987	13	6	275	3,575
1988	20	31	355	2,275
1989	79	19	313	1,837
1990	29	97	275	2,054
1991	159	142	504	2,066
1992	120	184	369	2,198
1993	158	98	352	2,492
1994	197	361	326	2,783
1995	1,244	149	345	2,791
1996	482	398	492	2,406
1997	255	127	419	1,711
Average	251	147	366	2,381
Standard	356	129	77	526

Data: Data compiled by NMFS staff from HDAR commercial catch reports (1997 data were extrapolated from preliminary reports).

Data source: P8797N.xls (6/30/98)

Interpretation: Landings of the traditional tuna species are within their recent ranges for the combined troll-handline fishery, although yellowfin was lower than it had been for some time. Distant-water albacore landings were not recorded in the amounts experienced in 1995, but albacore has become a more important species for both troll, handline, and longline gears.

Figure 23. Hawaii commercial pelagic trips by non-longline gears

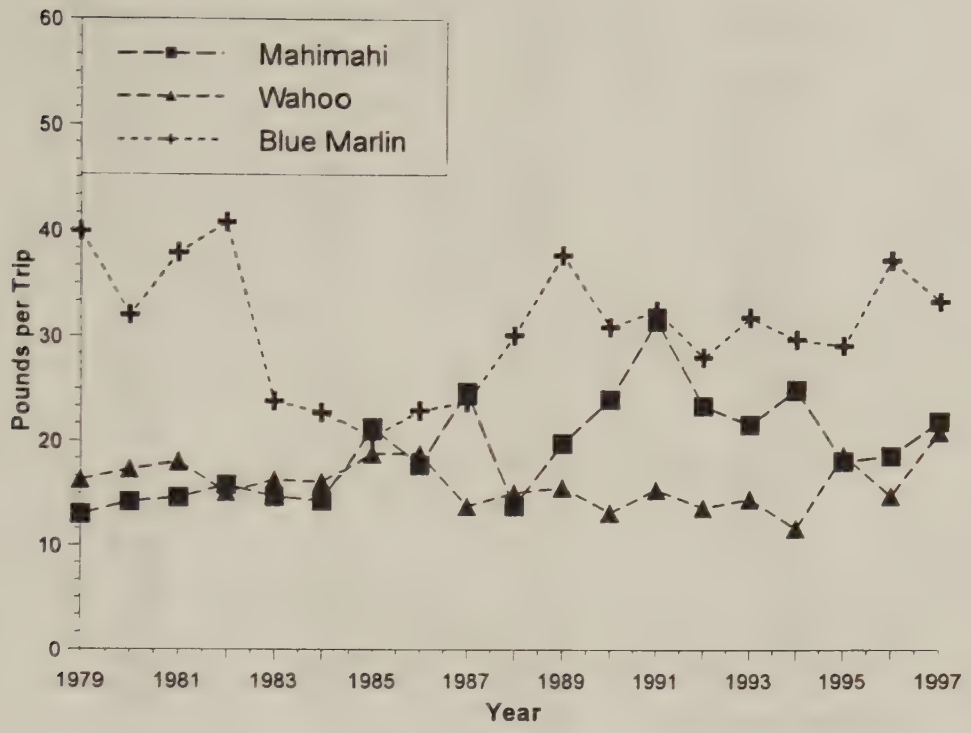


Interpretation: Trolling activity has continued at a high level between 20,000 and 25,000 trips per year since 1986, despite a small decline in 1996. After a low period in the late-1980's to mid-1990's, handline trips were relatively high in 1996. Although the number of trips dropped slightly in 1997, it remained slightly above the long-term average. Baitboat activity remained below the long-term average, but it has shown a small revival recently after a long decline. The recent success of a new baitboat in the fleet may prompt the building of more modern baitboats.

Data: Data compiled from HDAR commercial catch reports (as of May 1998) using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips).

Year	Number of Trips		
	Troll	Baitboat	Handline
1979	10,185	1,495	3,346
1980	12,692	1,149	6,746
1981	11,975	1,059	6,562
1982	10,039	1,067	5,219
1983	12,842	1,014	6,275
1984	14,556	1,232	5,248
1985	15,291	924	3,929
1986	20,139	941	6,412
1987	23,391	938	7,263
1988	20,202	941	6,647
1989	18,924	723	5,834
1990	20,468	378	4,261
1991	23,184	463	4,861
1992	20,109	510	4,374
1993	20,647	477	4,343
1994	20,905	281	4,142
1995	23,527	376	5,357
1996	21,611	438	6,416
1997	**23,129**	**404**	**5,697**
Average	18,096	779	5,417
Standard Deviation	4,694	355	1,132

Figure 24. Commercial trolling catch per trip -- mahimahi, wahoo and blue marlin

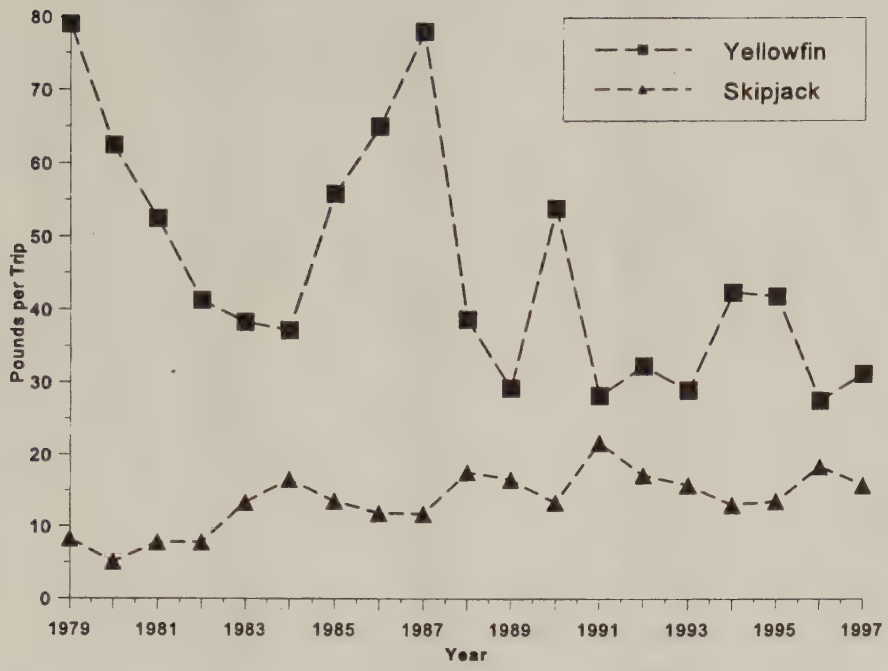


Interpretation: The troll catch rates for non-tuna species were somewhat variable. The catch rate for blue marlin increased in 1996 to the highest level since 1989 but dropped to within the long-term average in 1997. The mahimahi catch rate increased slightly and was well within the long-term average catch rate. The wahoo catch rate reached a new peak in 1997 and above the long-term average. Reported troll mahimahi landings were 507,319 pounds, wahoo 484,284 pounds, and blue marlin 771,092 pounds.

Data: Data compiled from HDAR commercial catch reports (as of May 1998) using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips).

Year	Pounds Caught per Trolling Trip		
	Mahimahi	Wahoo (Ono)	Blue Marlin
1979	13.0	16.3	39.9
1980	14.2	17.3	32.0
1981	14.6	18.0	37.9
1982	15.8	15.1	40.8
1983	14.7	16.3	23.8
1984	14.3	16.1	22.7
1985	21.3	18.8	20.3
1986	17.7	18.8	22.9
1987	24.7	13.8	23.7
1988	13.8	15.1	30.1
1989	19.8	15.6	37.7
1990	24.0	13.2	30.9
1991	31.5	15.4	32.5
1992	23.4	13.7	28.0
1993	21.6	14.5	31.8
1994	24.9	11.7	29.7
1995	18.1	18.7	29.1
1996	18.6	14.8	37.2
1997	**21.9**	**20.9**	**33.3**
Average	19.4	16.0	30.8
Standard Deviation	5.0	2.3	6.2

Figure 24a. Commercial trolling catch per trip -- yellowfin & skipjack tuna

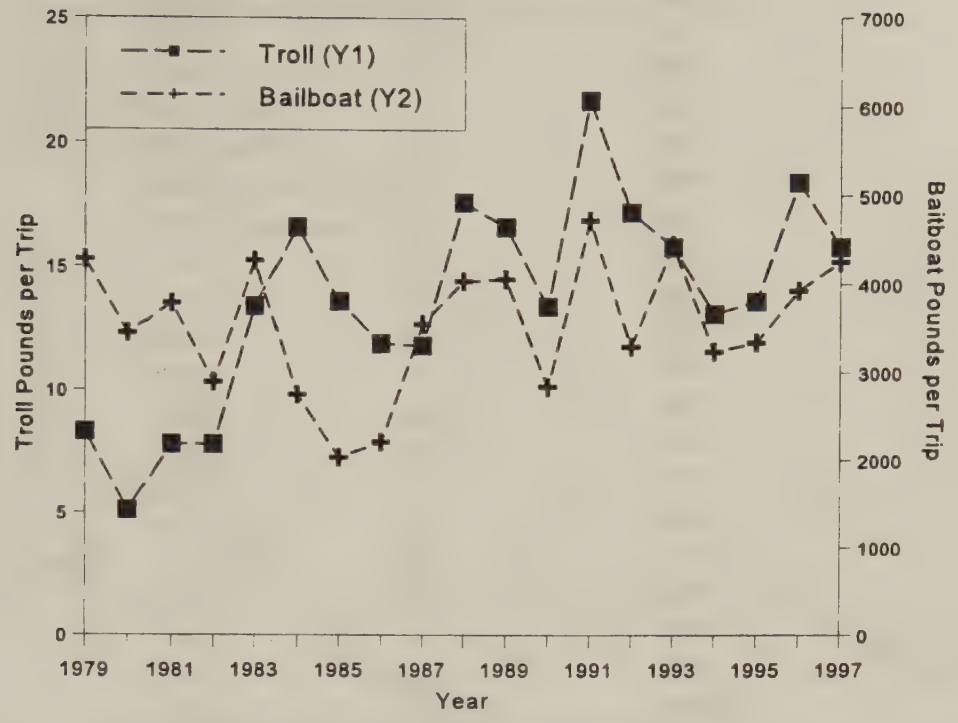


Interpretation: The 1997 troll yellowfin tuna catch rate rose from the record low in 1996, coming within the long-term average. The skipjack catch rate declined from the recent high in 1996, but although well within the long-term average, the catch rate shows a generally rising trend since 1980. Reported troll landings were 721,372 pounds for yellowfin and 365,174 pounds for skipjack.

Data: Data compiled from HDAR commercial catch reports (as of May 1998) using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips).

	Pounds per Trolling Trip	
Year	**Yellowfin**	**Skipjack**
1979	79.0	8.3
1980	62.5	5.1
1981	52.5	7.8
1982	41.3	7.8
1983	38.3	13.4
1984	37.2	16.6
1985	55.9	13.6
1986	65.1	11.9
1987	78.1	11.8
1988	38.7	17.6
1989	29.2	16.6
1990	53.9	13.4
1991	28.2	21.7
1992	32.3	17.2
1993	28.9	15.8
1994	42.4	13.1
1995	41.9	13.6
1996	27.5	18.4
1997	**31.2**	**15.8**
Average	45.5	13.7
Standard Deviation	16.0	4.1

Figure 25. Baitboat & commercial trolling catch per trip -- skipjack tuna

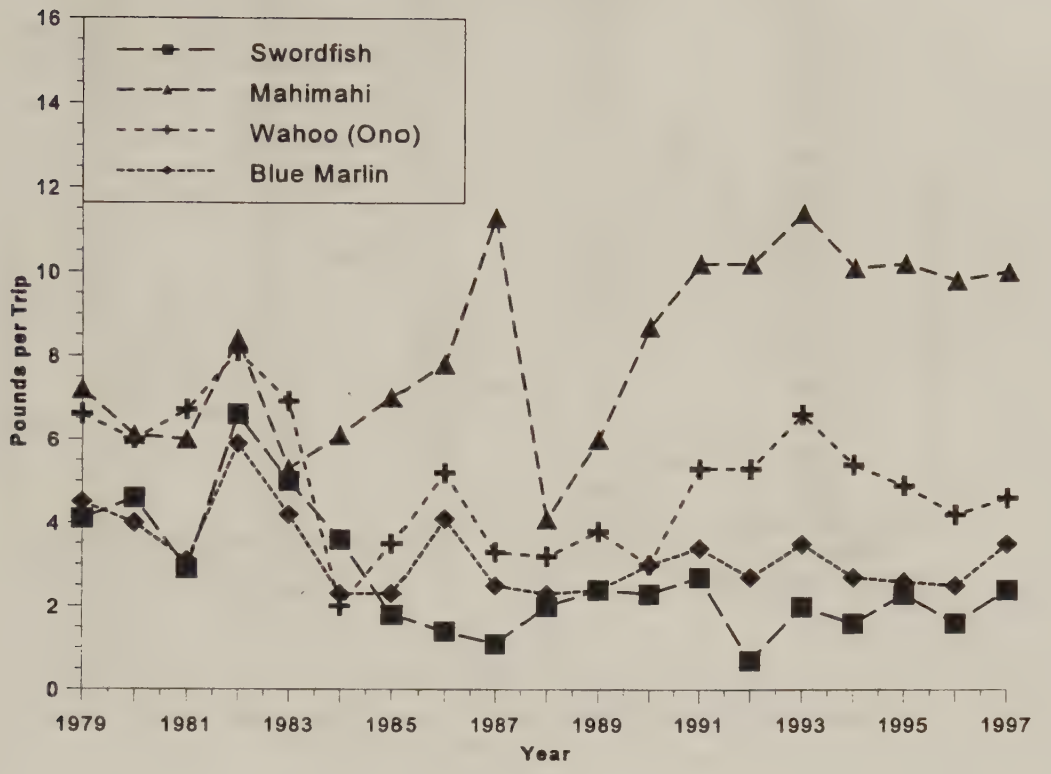


Interpretation: This figure shows the close correspondence of baitboat and trolling catch rates for skipjack once the level of cannery catch declined substantially, beginning in the mid-1980s. The 1997 baitboat catch rate rose again and exceeded the long-term average, although not yet at the level set in 1991. Although there are fewer boats in the aging baitboat fleet, those that remain are performing well. HDAR reports show the baitboats landing more than 1.7 million pounds of skipjack tuna in 1997.

Data: Data compiled from HDAR commercial catch reports (as of May 1998) using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips).

	Pounds Skipjack Caught per Trip	
Year	Trolling	Baitboat
1979	8.3	4,278
1980	5.1	3,447
1981	7.8	3,786
1982	7.8	2,892
1983	13.4	2,468
1984	16.6	2,748
1985	13.6	2,031
1986	11.9	2,206
1987	11.8	3,548
1988	17.6	4,036
1989	16.6	4,061
1990	13.4	2,840
1991	21.7	4,722
1992	17.2	3,297
1993	15.8	4,447
1994	13.1	3,240
1995	13.6	3,341
1996	18.4	3,928
1997	**15.8**	**4,253**
Average	13.7	3,451
Standard Deviation	4.2	774

Figure 26. Combined commercial handline catch per trip -- swordfish, mahimahi, ono (wahoo), & blue marlin

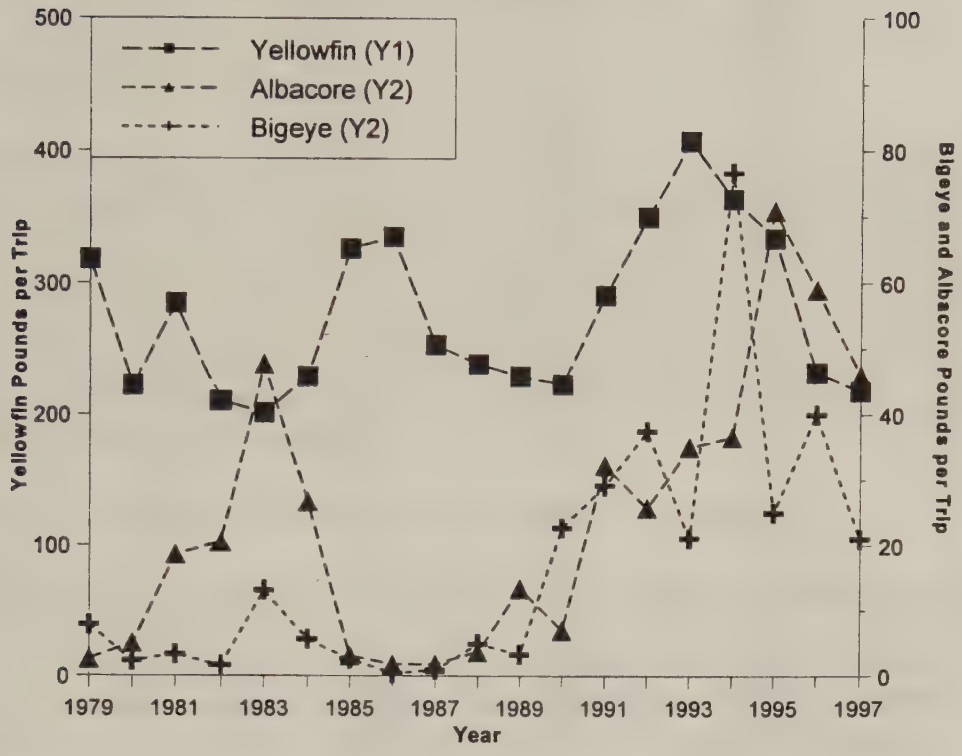


Interpretation: Catch rates in the handline fishery remained within their long-term averages. The mahimahi catch rate show a high degree of variability from 1979 to 1991, but since then has been consistently high. Non-tuna species do not form a major component of the handline fishery landings. Reported handline swordfish landings were 13,796 pounds, mahimahi 34,108 pounds, wahoo 26,327 pounds, and blue marlin 19,850 pounds.

Data: Data compiled from HDAR commercial catch reports (as of May 1998) using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips). Data combined from reported ika-shibi, palu-ahi, and drifting handline methods.

Year	Swordfish	Mahimahi	Wahoo	Blue marlin
1979	4.1	7.2	6.6	4.5
1980	4.6	6.1	6.0	4.0
1981	2.9	6.0	6.7	3.1
1982	6.6	8.4	8.1	5.9
1983	5.0	5.3	6.9	4.2
1984	3.6	6.1	2.0	2.3
1985	1.8	7.0	3.5	2.3
1986	1.4	7.8	5.2	4.1
1987	1.1	11.3	3.3	2.5
1988	2.0	4.1	3.2	2.3
1989	2.4	6.0	3.8	2.4
1990	2.3	8.7	3.0	3.0
1991	2.7	10.2	5.3	3.4
1992	0.7	10.2	5.3	2.7
1993	2.0	11.4	6.6	3.5
1994	1.6	10.1	5.4	2.7
1995	2.3	10.2	4.9	2.6
1996	1.6	9.8	4.2	2.5
1997	**2.4**	**10.0**	**4.6**	**3.5**
Average	2.7	8.2	5.0	3.2
Standard Deviation	1.5	2.2	1.6	1.0

Figure 27. Combined commercial handline catch per trip -- yellowfin, albacore and bigeye tunas



Interpretation: The catch rates for the three tuna species dropped from the previous year. Yellowfin and bigeye catch rates remained within their long-term averages, while albacore was above the long-term average. The yellowfin catch rate was at the lowest level since 1982. Reported handline landings were 1,239,184 pounds for yellowfin, 262,868 pounds for albacore, and 119,854 pounds for bigeye. The bigeye landings seem low and may indicate problems in species identification.

Data: Data compiled from HDAR commercial catch reports (as of May 1998) using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips). Data combined from reported ika-shibi, palu-ahi, and drifting handline methods.

Year	Yellowfin	Albacore	Bigeye
1979	318	3	8
1980	222	5	2
1981	285	19	3
1982	211	21	2
1983	201	48	13
1984	229	27	6
1985	326	3	3
1986	335	2	0
1987	253	2	1
1988	238	4	5
1989	229	13	3
1990	223	7	23
1991	291	32	29
1992	350	26	38
1993	408	35	21
1994	364	37	77
1995	334	71	25
1996	232	59	40
1997	**218**	**46**	**21**
Average	277	24	17
Standard Deviation	62	21	19

Appendix 4

Commonwealth of the Northern Mariana Islands

Introduction

The Northern Mariana Islands pelagic fishery occurs from the island of Farallon de Medinilla south to the island of Rota. The fishery is characterized using data in the Commercial Purchase Data Base. The collection system for the data is dependent upon first-level purchasers of local fresh fish to accurately record all fish purchases by species categories on specially designed invoices. Staff from the Department of Lands and Natural Resources, Division of Fish and Wildlife (DFW) routinely distribute and collect invoice books from 70 participating local fish purchasers on Saipan. Purchasers include practically all fish markets, stores, restaurants, hotels and roadside vendors ("fish-mobiles").

No data collection system is currently operative on Rota or Tinian.

Although the Saipan data collection system has been in operation since the mid-1970s, only data collected since 1983 are considered accurate enough to be used. Data quality, with respect to accuracy of landings and species identification on the invoice experienced problems this past year, as data collection effort reached an all time low. These problems have since been examined and remedies have been instituted. It is assumed that data in this report are credible.

This database lacks information concerning fishing method, location and effort because previous data generated from Creel Survey are believed to be unreliable. Estimates of total landings and CPUE's have yet to be generated.

To fish commercially within the NMI's exclusive economic zone (EEZ), commercial vessels over five net tons must have a Commercial Fishing License issued annually and jointly by the Department of Commerce and the Department of Lands and Natural Resources. Depending on the information supplied in the application package, the DFW may impose certain fishing restrictions in the form of license conditions. Although commercial boats under five net tons are not required to have a license to fish, all fishing boats are registered with the Department of Public Safety(DPS).

Summary

Trolling is the only fishing method utilized in the pelagic fishery. The pelagic fishing fleet, other than charter boats, consists primarily of vessels less than 24 ft in length which usually have a limited 20-mile travel radius from Saipan. In 1997, about 74% of all registered boats participated in some form of fishing activity. One hundred and thrity-two vessels were identified as being involved in full-time commercial fishing and 101 vessels were classified as part-time. Subsistence fishing and/or recreational usage included 306 vessels.

In 1997, 43 vessels were registered with the Boating Safety Office as charter vessels, although only 11 vessels conducted full-time charter fishing operations, two of which were full-time shallow water bottom fishing. One vessel sunk while actively chartering. No lives were lost.

The remaining 34 charter vessels are associated with part-time fishing and the tourist transport industry. Charter vessels generally retain their catches, selling half or more to local markets. While the general magnitude of charter boat sales is unknown, it is questionable whether the local market can absorb these catches without impacting commercial fishermen. No logbook system is currently in effect.

The primary marketable target species for the pelagic fleet is skipjack tuna. Yellowfin and mahimahi have also become marketable species. During their seasonal runs, these fish are usually found close to shore and provide easy targets for the local fishermen. In addition to the economic advantages of being near shore and their relative ease of capture, these species are widely accepted by all ethnic groups. This has kept market demand fairly high due to the continuing immigrant population growth on Saipan (over half of the population on Saipan is non-native).

The use of larger vessels (>50 ft) for pelagic fishing remains limited. Four commercial fishing licenses were issued in 1997, four in 1996, four in 1995, four in 1994, two each in 1993 and 1992, and none in 1991. In 1997 two licensed vessels fished during the full 12 month calendar year, with a third commencing operations in December. These three vessels primarily targeted bottom fish, landing pelagics incidentally.

Recommendations

1) To request from WPRFMC for its assistance in providing the CNMI with some expertise (training) in the area of offshore creel census, both on data collection and analyzing.

2) To assist the CNMI in evaluating and salvaging its prior years offshore creel data collection as recommended by Mr. Dave C. Hamm of the Honolulu Laboratory. We are hopeful that the data collected in the past are adequate and useful for analyses.

3) A careful review and comparison of length frequencies and regional landings should be conducted to obtain general biological characteristics from the fishery.

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Table 1. NMI 1997 commercial pelagic landings, revenues and price

Species	Landings (lb)	Revenue ($)	Ave. Price ($/lb)
Misc. tunas	3,822	7,360	1.93
Skipjack tuna	106,637	230,951	2.17
Yellowfin tuna	17,121	42,580	2.49
Subtotal Above Tunas	**127,580**	**280,891**	**2.20**
Dogtooth tuna	7,616	17,269	2.27
Mahimahi	25,021	50,325	2.01
Marlin	5,655	10,425	1.84
Sailfish	100	199	1.99
Wahoo	6,064	13,696	2.26
Subtotal Other PPMUS	**44,456**	**91,914**	**2.07**
Troll fish	1,962	3,987	2.03
Barracuda	177	387	2.19
Rainbow runner	740	1,967	2.66
Subtotal Misc.	**2,879**	**6,341**	**2.20**
All Pelagics	**174,915**	**379,146**	**2.07**

Interpretation: Skipjack landings decreased by 19% or over 25,000 pounds in 1997. Skipjack continued to dominate the pelagic landings, comprising nearly 61% of the (commercially receipted) industry's pelagic catch. Mahimahi and yellowfin tuna were still ranked second and third in total landings during 1997, although landings of each decreased by 12% and 44% from 1996, respectively. Schools of mahimahi, like skipjack tuna, are easily caught in near shore waters. Mahimahi are highly seasonal with peak catch rates usually from February through April. Yellowfin season usually runs from April to September. Overall pelagic catch decreased over 49,000 pounds or 22% in 1997. The sudden decrease in all areas of landings and revenues in this report might be partially due to data collection problems, the Asian economic crisis which resulted in the loss of some Korean buyers, and possibly ENSO conditions.

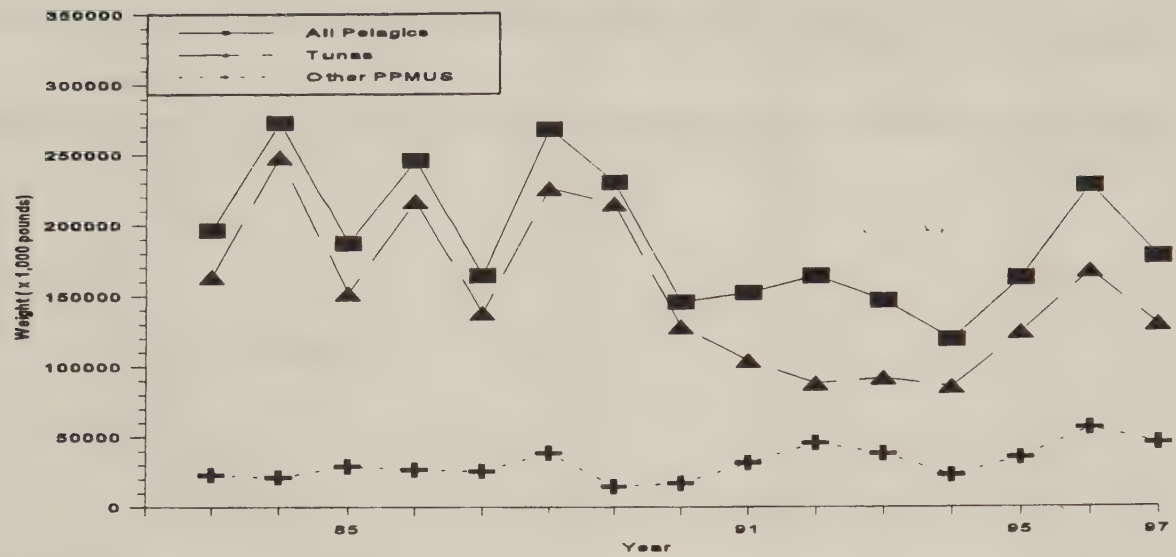
The highest average price of identified pelagic species was $2.66/lb for Rainbow Runner, which is up from the 1996 high of $2.60/lb. The lowest priced species remained marlin at $1.84/lb, which decreased $1.91/lb in 1996. In 1997, dogtooth continued to increase in value over 1996 prices, from $2.07/lb to $2.27/lb. Wahoo decreased from $2.33/lb to $2.26/lb. The average price per pound for skipjack tuna, the species with the greatest landings, increased by 18% from $1.84/lb in 1996 to $2.17/lb in 1997. The market share of total pelagic revenues by combining yellowfin tuna and mahimahi decreased from $117,406 or 27% in 1996, to $92,905 or 24% in 1997. Skipjack revenue decreased from $243,697 or 56% in 1996, to $230,951 or 61% of the total pelagic revenue in 1997.

Blue marlin, which again brought the lowest average price in 1997, is taken primarily by charter boat fishers. The catch of blue marlin decreased from 6,874 pounds in 1996 to 5,655 pounds or by 18% in 1997. Other recreational fishers also take it during scheduled fishing tournaments. At the annual Saipan Fishing Derby held in August, a female Blue Marlin weighing 661 pounds was landed. Although not generally regarded as a high quality food fish, marlin sashimi is sold in local restaurants and hotels. It is also served in public institutions. The low ex-vessel price may be

partly related to the manner in which the fish is kept prior to sale(these fish are generally not iced when caught and therefore are usually of lower quality at the time of sale), the bulky size, and the relative quality of the cooked product. Fishers generally sell the whole fish to avoid cleaning and repackaging into smaller units.

Source and Calculation: Annual summaries for each species from the Commercial Purchase Data Base invoices.

Figure 1. NMI annual commercial landings: all pelagics, tuna and PPMUS.

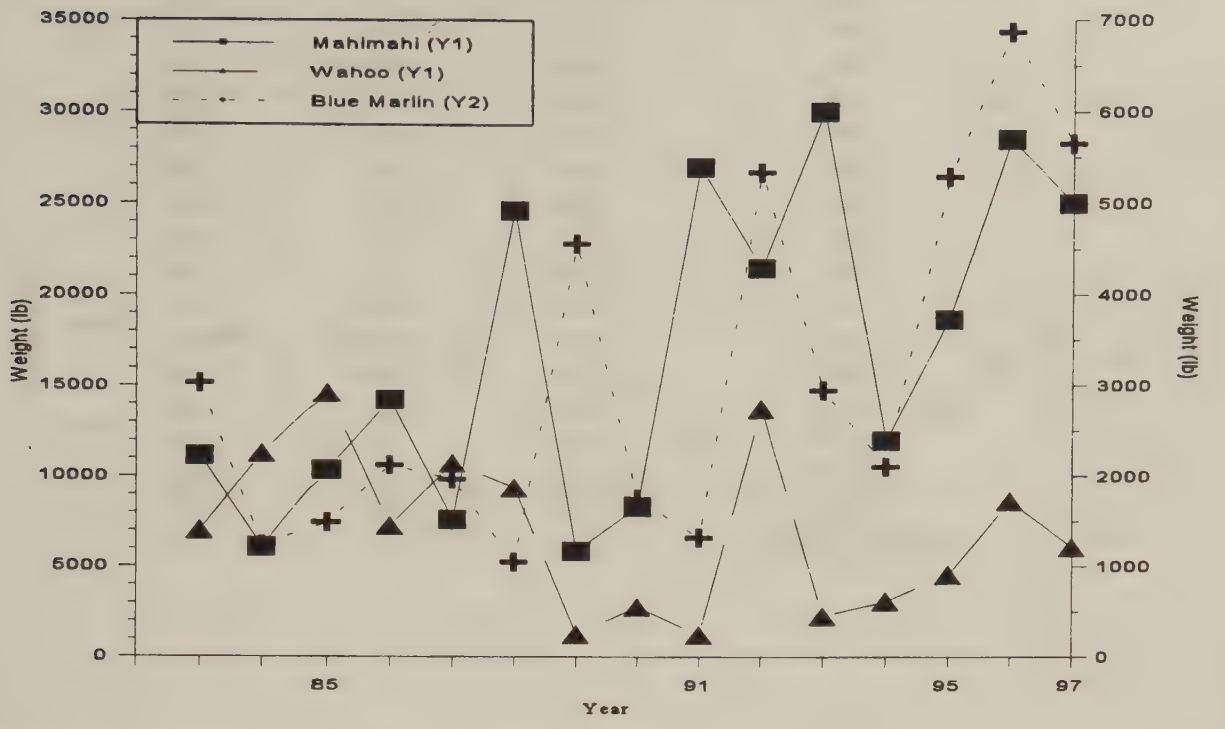


Interpretation: Total weight of pelagics landed in 1997 declined 22% from 1996 levels. Tuna landings of decreased by 23% or over 37,500 pounds from 165,122 pounds in 1996 to 127,580 pounds in 1997, approaching 1995 levels. Although this was a sharp decrease compared to the previous six years average of 102,497 pounds, it still exceeds the 1991-1996 average of 108,822 pounds, while it continues to fall well short of the 1983 - 1990 average of 185,685 pounds. Catch in the 'Other PPMUS' category decreased by 19%.

Source and Calculation: All pelagics, tuna and other PPMUS landings were summed from the Commercial Purchase Data Base.

	Total Landings (lb)		
Year	**All Pelagics**	**Tunas**	**Other PPMUS**
1983	196,788	163,754	23,081
1984	272,909	248,339	21,223
1985	187,378	151,882	29,105
1986	245,967	217,023	26,800
1987	164,055	137,566	25,467
1988	267,619	225,498	38,368
1989	229,427	214,249	14,650
1990	144,862	127,172	16,893
1991	150,915	103,078	31,300
1992	162,691	86,931	45,061
1993	145,115	90,584	37,628
1994	117,668	8,4598	22,701
1995	160,540	122,616	34,863
1996	224,962	165,122	55,088
1997	**174,914**	**127,580**	**44,455**
Average	189,721	151,066	31,112
Standard Deviation	47,948	53,659	11,394

Figure 2. NMI annual commercial landings: mahimahi, wahoo, and marlin



Interpretation: Mahimahi landings decreased by 12% in 1997 from 28,524 pounds in 1996 to 25,021 pounds in 1997. It is noteworthy that the NMI and Guam mahimahi catches have fluctuated similarly since 1987, which may indicate a strong biological influence in local landing patterns.

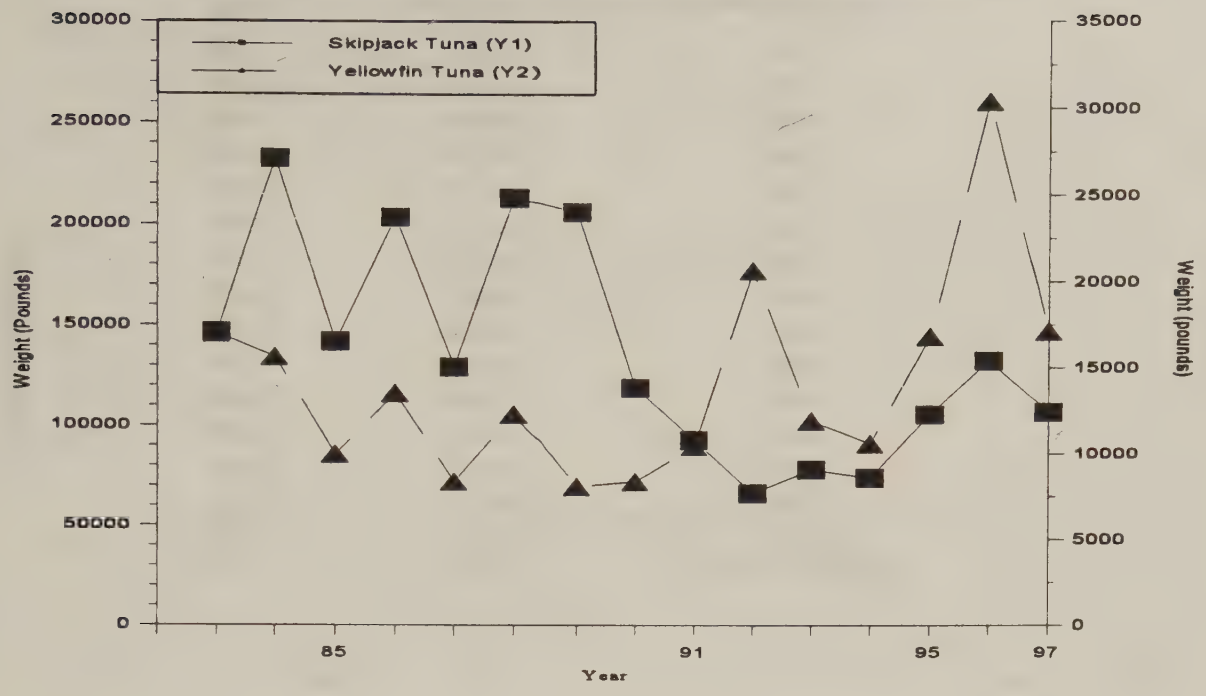
From 1983 to 1988, wahoo landings were somewhat consistent and did not fall below 7,000 lb, but in 1989 landings notably declined by 86% and remained at depressed levels until the dramatic increase in landings during 1992. Following the near-record 1992 landings, the 1993 wahoo landings again decreased by 84%, falling below the mean. Wahoo landings in 1997 decreased by 2,562 pounds or 30% over the 1996 landings.

The blue marlin landings of 5,655 pounds in 1997 is the second highest recorded, although an 18% decrease from 1996.

Source and Calculation: The annual commercial landings of the three major PPMUS species (mahimahi, wahoo and blue marlin) were summed directly from the Commercial Purchase Data Base.

	Total Commercial Landings (lb)		
Year	Mahimahi	Wahoo	Blue Marlin
1983	11,151	7,008	3,030
1984	6,091	11,270	1,235
1983	10,364	14,601	1,488
1986	14,237	7,250	2,123
1987	7,602	10,723	1,968
1988	24,639	9,358	1,047
1989	5,856	1,257	4,563
1990	8,306	2,770	1,748
1991	27,005	1,217	1,320
1992	21,462	13,738	5,345
1993	30,036	2,257	2,950
1994	11,993	3,090	2,108
1995	18,657	4,555	5,295
1996	28,524	8,626	6,874
1997	**25,021**	**6,064**	**5,655**
Average	16,730	6,919	3,117
Standard Deviation	8,722	4,411	1,914

Figure 3. NMI annual commercial landings: skipjack and yellowfin tuna



Interpretation: Historically, skipjack landings exhibited an alternating two-year cycle from 1983 to 1988 and comprised over 73% by weight of the total pelagic landings each year from 1983 to 1989 (data taken from Table 1 and Fig. 3). Skipjack tuna landings declined after that, reaching record lows from 1990 through 1994. In 1993 and 1994 skipjack landings showed signs of stabilizing at about half of their respective eleven and twelve year means, while the nearly 32,000 pound increase in 1995 landings attained 61% of the 1983-1990 average of 174,020 pounds. In comparison to 1996 skipjack landings, 1997 landings decreased by 19%. This decrease may be part of an overall decrease due to a decline in data collection, the Asian economic crisis which caused the closure of numerous Korean vendors, and possibly ENSO.

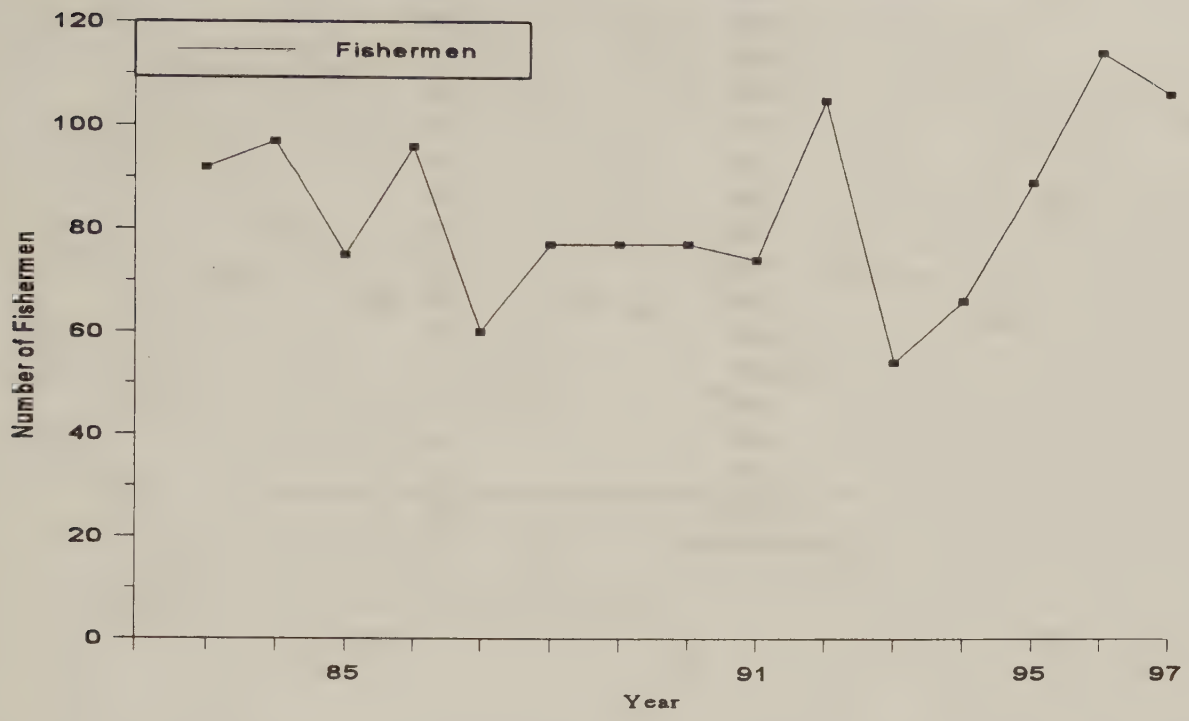
Schools of skipjack tuna have historically been common in near shore waters, providing an opportunity to catch numerous fish with a minimum of travel time and fuel costs. Skipjack are readily consumed by the local populace, primarily as sashimi.

Although more highly prized than skipjack, yellowfin tuna are not as common, and therefore not landed as often. The average fish size tends to be smaller when compared with yellowfin tuna from other geographic areas. The 1997 landings decreased by 44% over 1996, surpassing the 1983-1994 average of 12,246 pounds.

Source and Calculation: Landings were summed directly from the Commercial Purchase Data Base.

	Total Commercial Landings (lb)	
Year	Skipjack tuna	Yellowfin tuna
1983	146,729	17,025
1984	232,675	15,664
1985	141,910	9,973
1986	203,490	13,533
1987	129,203	8,363
1988	213,198	12,300
1989	206,162	8,087
1990	118,798	8,374
1991	92,642	10,433
1992	65,982	20,672
1993	77,832	11,919
1994	73,769	10,600
1995	105,423	16,824
1996	132,155	30,410
1997	106,637	17,121
Average	136,440	14,087
Standard Deviation	54,197	5,914

Figure 4. Number of NMI fishermen (boats) making commercial pelagic landings.



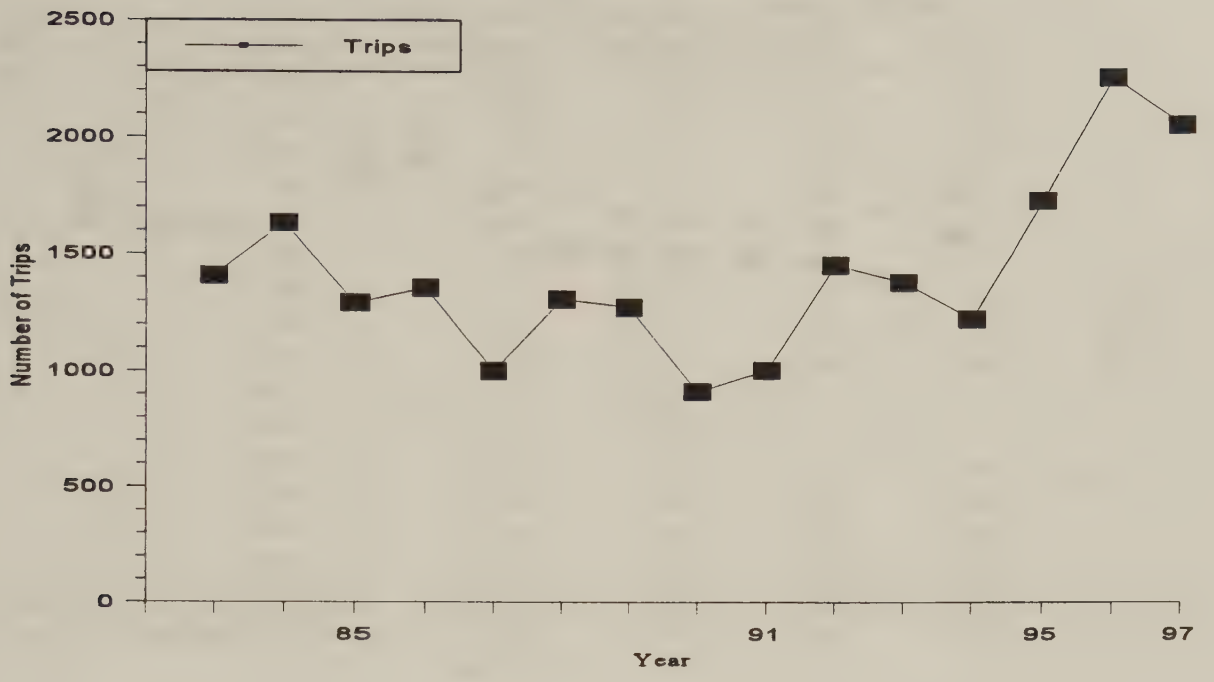
Interpretation: The number of fishers (boats) making commercial pelagic landings was relatively constant from 1988-91 compared to earlier years, but a record high number was recorded for 1992 (30% from 1991). Some of the increase in 1992 was attributable to the influx of new fishing boats as a result of money obtained by leasing property. In addition, it was discovered that some fishers were using several different boats, thus artificially inflating the total number of boats making pelagic landings.

Many of 1992's "new" fishers, with their new boats, are believed to have left the fishery during 1993. The number of fishers in 1997 decreased by 7% from 1996. It has been suggested that the 1994 increase may have been due to the re-entry of repaired and refurbished boats from the 1992 fleet. It is possible that this activity has continued to play a role

Source and Calculation: Each invoice from the Commercial Purchase Data Base records the fisherman's name from whom the fish were purchased. The number of fishermen who sold any pelagic species was calculated directly from the data invoices.

Year	No. fishermen landing any pelagic species
1983	92
1984	97
1985	75
1986	96
1987	60
1988	77
1989	77
1990	77
1991	74
1992	105
1993	54
1994	66
1995	89
1996	114
1997	**106**
Average	84
Standard Deviation	18

Figure 5. NMI number of trips catching any pelagic fish

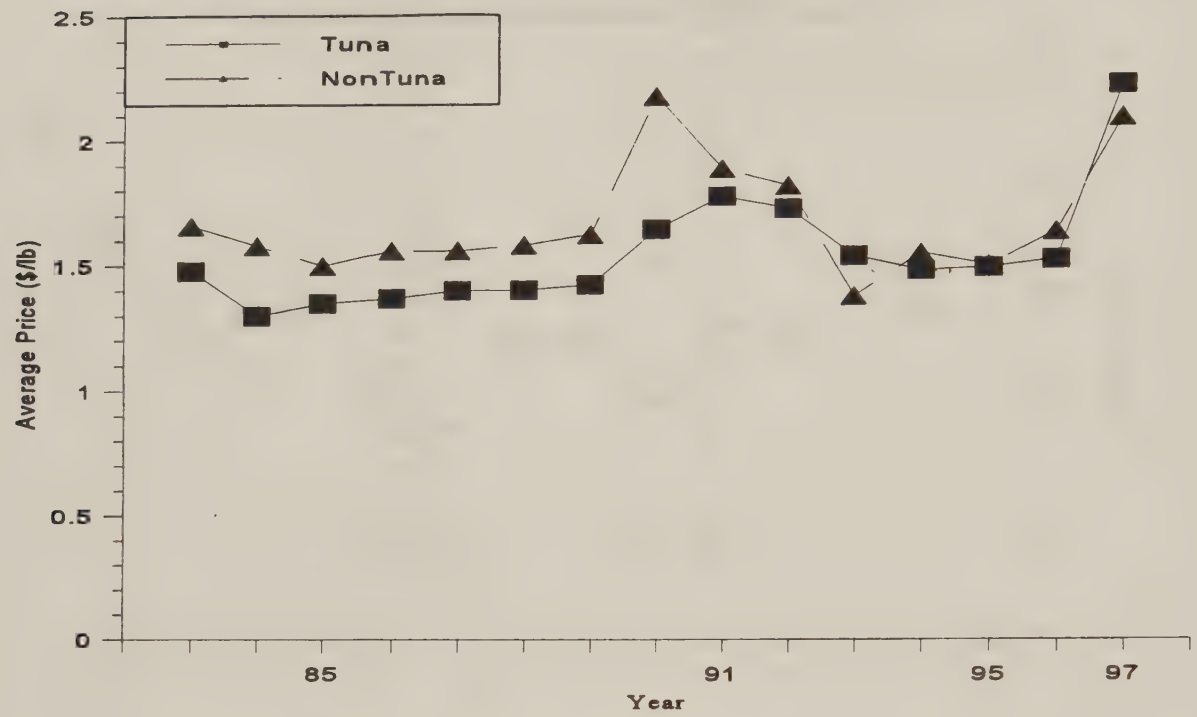


Interpretation: The number of pelagic trips decreased in 1997 by 9% from 2.254 to 2.047, although still well above the fifteen year average of 1.417. to an all time high in 1996, which corresponds well with the tabled data from the previous four graphs which show an increase in landings and number of fishers. This decrease could be due to a decline in the quality of data collection, or possibly the effects of ENSO.

Source and Calculation: The total trips for all pelagic species were summed from the Commercial Purchase Data Base. Trips were calculated based on the assumptions that no fisherman makes more than one trip per day, and that all sales from a single trip are made on a single day.

Year	Number trips
1983	1,408
1984	1,634
1985	1,293
1986	1,356
1987	999
1988	1,306
1989	1,272
1990	910
1991	1,002
1992	1,451
1993	1,378
1994	1,221
1995	1,727
1996	2,254
1997	**2,047**
Average	1,417
Standard Deviation	372

Figure 6. NMI average inflation-adjusted price of tunas and other PPMUS.



Interpretation: The inflation-adjusted average price of tuna was stable from 1983 until 1989, when an obvious rise was observed. The 1990-92 rise in price corresponds with the notable decrease in skipjack tuna landings (Fig. 3) during the same period of time. In 1994 commercially receipted tunas commanded a lower price than in recent years. However, considering the inflation-adjusted prices from 1983 to 1996, it would appear that tuna prices have, on the whole, kept pace with inflation. The 31% increase from 1996 to 1997 is possibly a result of the decrease in overall landings, which may be related to the change in oceanographic conditions caused by El Nino.

In 1997 the relative value of tuna to the "Other PPMUS" category switched for the first time in four years.

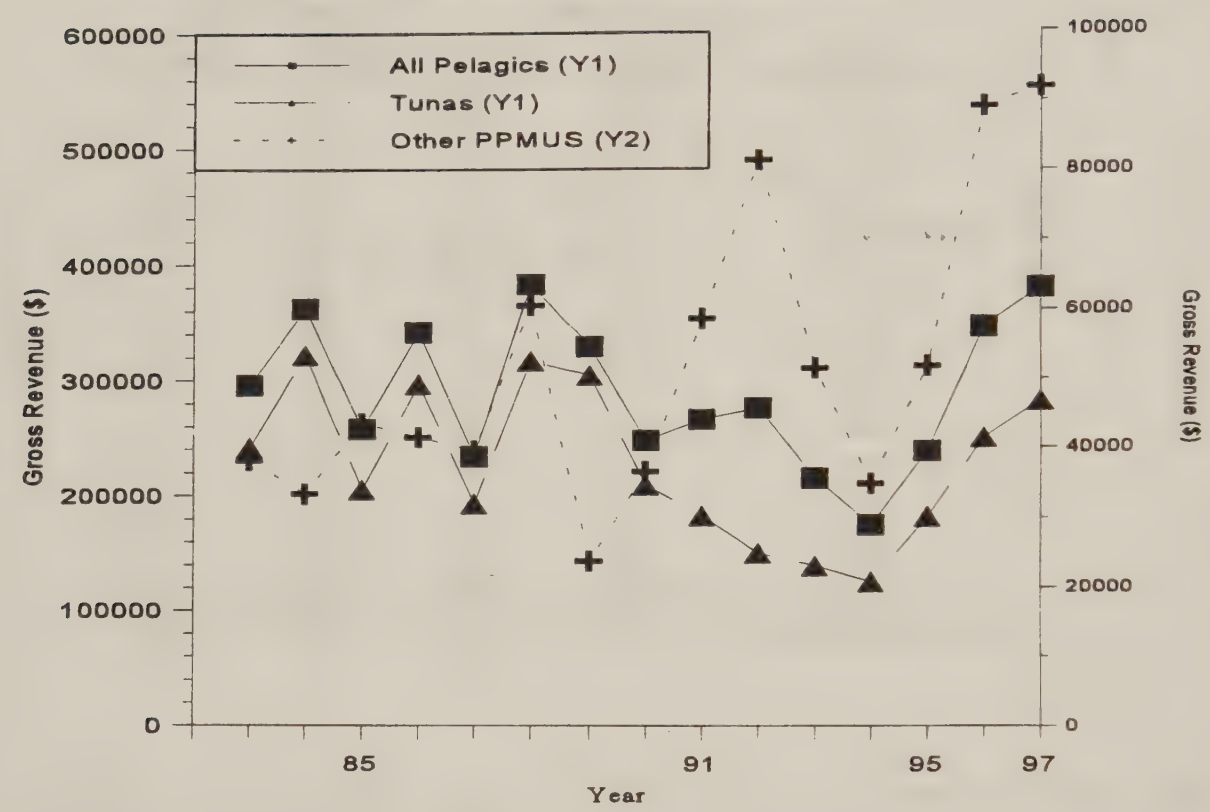
The "new" and large Korean market which was alluded to in 1996, has, as previously mentioned, declined due to the Asian economic crisis. This crisis has resulted in the loss of many Korean buyers, as the hotels, restaurants, and Korean community have realized economic loss due to the sharp decline in the number of Korean tourists.

Fuel prices have remained constant from 1996.

Source and Calculation: The unadjusted average price is calculated by dividing the total revenues generated by the total weight sold. The inflation adjustment is made using the 1996 NMI Consumer Price Index (CPI) as the basis by which calculations of previous years' prices are made.

	Average Price ($/lb)			
	Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted
1983	0.99	1.48	1.12	1.66
1984	0.95	1.30	1.15	1.58
1985	1.02	1.35	1.14	1.50
1986	1.07	1.37	1.22	1.56
1987	1.14	1.40	1.27	1.56
1988	1.20	1.40	1.35	1.58
1989	1.29	1.42	1.48	1.62
1990	1.56	1.64	2.07	2.17
1991	1.80	1.77	1.92	1.88
1992	1.91	1.72	2.01	1.81
1993	1.78	1.53	1.59	1.37
1994	1.75	1.47	1.83	1.54
1995	1.80	1.48	1.81	1.49
1996	1.89	1.51	2.02	1.62
1997	**2.20**	**2.20**	**2.07**	**2.07**
Average	1.49	1.54	1.60	1.67
Standard Deviation	0.41	0.23	0.37	0.22

Figure 7. NMI annual commercial adjusted revenues



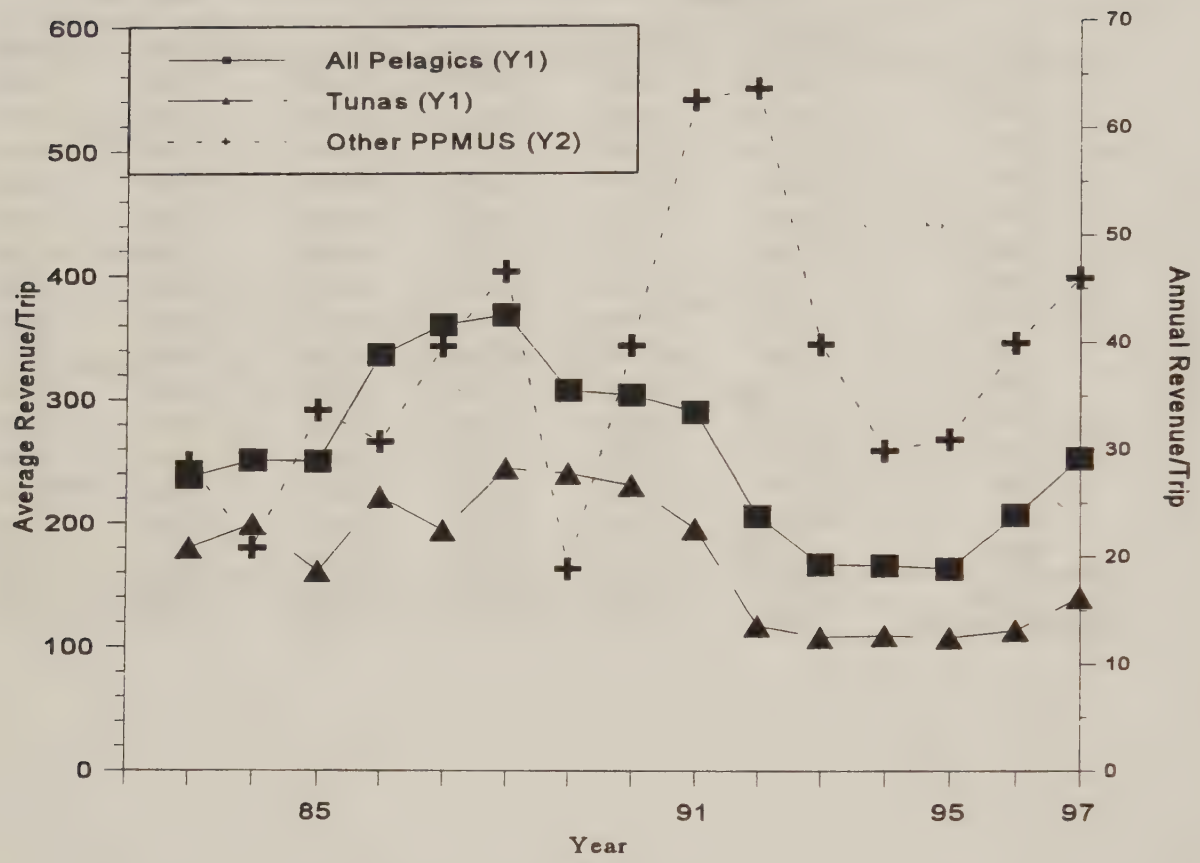
Interpretation: The erratic fluctuations of the inflation-adjusted revenues for Tunas and for All Pelagics prior to 1990 is most likely due to the annual variations in skipjack tuna landings (see Fig. 3) which completely dominate the tuna category and, therefore, the All Pelagics category. The divergence of All Pelagics and Tunas in 1991 and 1992, which normally correspond, is corrected between 1993 and the end of 1996.

The tunas' inflation-adjusted revenues increased 11% in 1997, surpassing the 1989 level. This increase is the result of the 18% increase in the price per pound for skipjack, as landings dropped considerably(Table 1). "Other PPMUS" inflation-adjusted revenues remained relatively constant, increasing 3% over the 1996 level.

Source and Calculation: Annual revenue in dollars was summed separately for all pelagic fish, tunas and other PPMUS. Inflation-adjusted revenues were calculated using the Consumer Price Index, with 1996 as a base by which previous years' nominal prices are adjusted.

	Revenues ($)					
	All Pelagics		Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
1983	198,710	296,078	162,240	241,738	25,770	38,397
1984	264,203	361,958	235,262	322,309	24,503	33,569
1985	195,372	257,891	155,171	204,826	33,162	43,774
1986	267,013	341,777	231,745	296,634	32,631	41,768
1987	190,150	233,885	156,634	192,660	32,333	39,770
1988	327,260	382,894	270,679	316,694	51,950	60,782
1989	299,142	329,056	276,671	304,338	21,635	23,799
1990	235,520	247,296	198,775	208,714	34,968	36,716
1991	271,030	265,609	185,662	181,949	60,031	58,830
1992	305,927	275,334	166,235	149,612	90,627	81,564
1993	249,136	214,257	161,100	138,546	60,001	51,601
1994	207,124	173,984	147,940	124,270	41,548	34,900
1995	289,740	237,587	220,633	180,919	63,264	51,876
1996	431,560	345,248	311,271	249,017	111,445	89,156
1997	**379,145**	**379,145**	**280,891**	**280,891**	**91,913**	**91,913**
Average	274,069	289,467	210,727	226,208	51,719	51,894
Standard Deviation	68,777	64,255	54,534	66,591	27,717	20,941

Figure 8. NMI annual commercial adjusted revenues for PPMUS trips only



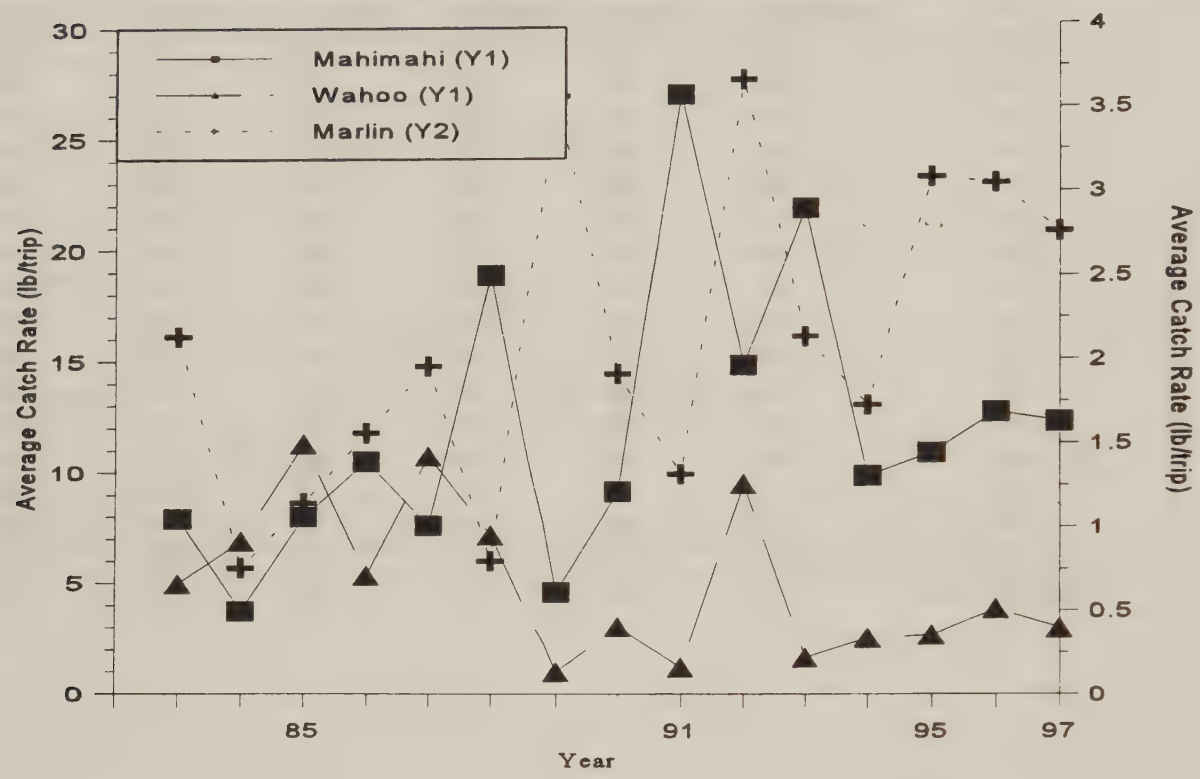
Interpretation: The inflation-adjusted revenues per trip for "All Pelagic Species" and "Tunas" indicates an increase by 18% and 19% respectively, in 1997. Except for "Other PPMUS", the current year inflation-adjusted values for all categories are still below their respective 15 year means.

Inflation-adjusted revenue per trip for "Other PPMUS" increased 13% from 1996. This may be due to fishers landing a wider variety of pelagics.

Source and Calculation: Values were obtained by selecting, from the Commercial Purchase Data Base, all trips which landed at least one PPMUS, and then calculating a) the average revenue of all species, b) the average revenue of other PPMUS only, and c) the average revenue of tuna only. Inflation-adjusted revenues were derived from the NMI Consumer Price Index (CPI) which used 1996 as a base.

	Revenues per PPMUS Trip ($)					
	All Pelagic Species		Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
1983	159	237	121	180	19	29
1984	183	251	145	199	15	21
1985	189	250	122	161	26	34
1986	262	336	172	221	24	31
1987	292	360	157	194	32	40
1988	315	368	209	244	40	47
1989	279	307	218	240	17	19
1990	289	303	219	230	39	40
1991	295	289	199	195	64	63
1992	228	205	130	117	71	64
1993	192	166	125	108	47	40
1994	197	165	129	109	36	30
1995	198	162	130	107	37	31
1996	256	205	141	113	51	40
1997	**250**	**250**	**139**	**139**	**46**	**46**
Average	239	257	157	170	38	38
Standard Deviation	50	69	37	52	16	13

Figure 9. NMI trolling catch rate of mahimahi, wahoo and marlin



Interpretation: The 1997 mahimahi catch rate remained constant from 1996, decreasing only 3% and still above the 15 year mean. This could be due in part to the absence of FADs, which attract the species, making it more accessible. It may also be biological because it appears that the trolling catch rates of Guam and the NMI have fluctuated similarly over the last fifteen years.

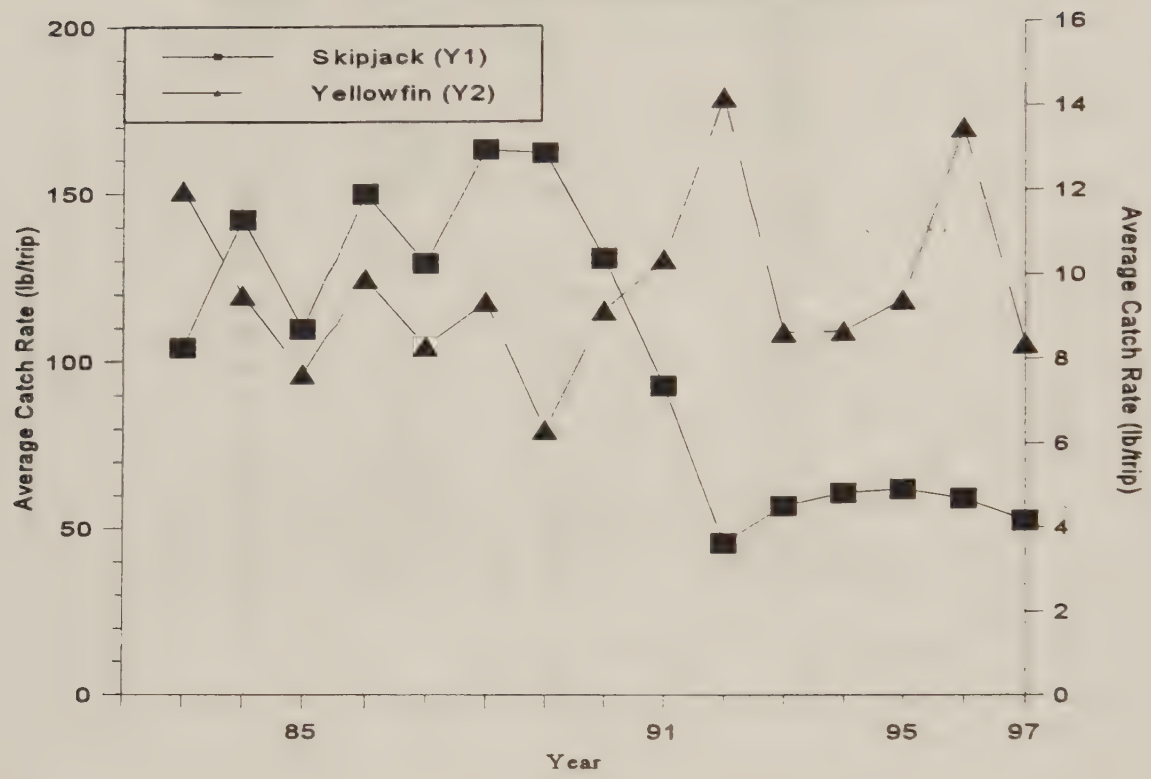
Prior to the 1989 record low, wahoo catch rates rivaled those for mahimahi. Wahoo catch rates have generally never regained those historical levels. The 1997 catch rate decreased by 23% from 1996, and remained less than the fifteen year mean of 4.98lb/trip.

Marlin catch rates declined by 9% from 1996 levels, continuing the trend of peaks every three years followed by declines of varying magnitude.

Source and Calculation: Annual catch rates for selected species were obtained by calculating the average weight per trip for each year. Trips were assumed to be one day in length and each commercial invoice assumed to represent one trip.

	Trolling Catch Rate (lb/trip)		
Year	**Mahimahi**	**Wahoo**	**Marlin**
1983	7.92	4.98	2.15
1984	3.73	6.90	0.76
1985	8.02	11.29	1.15
1986	10.50	5.35	1.57
1987	7.61	10.73	1.97
1988	18.87	7.17	0.80
1989	4.60	0.99	3.59
1990	9.13	3.04	1.92
1991	26.95	1.21	1.32
1992	14.79	9.47	3.68
1993	21.80	1.64	2.14
1994	9.82	2.53	1.73
1995	10.80	2.64	3.07
1996	12.65	3.83	3.05
1997	**12.22**	**2.96**	**2.76**
Average	11.96	4.98	2.11
Standard Deviation	6.36	3.42	0.94

Figure 10. NMI trolling catch rates of skipjack and yellowfin tuna



Interpretation: Catch rates for skipjack tuna decreased dramatically commencing in 1990. The 1992 through 1997 catch rates have appeared to stabilize around the six year mean of 55.7lb/trip. Skipjack tuna are the preferred species in the troll fishery of the NMI because of their relative ease of capture and local popularity as sashimi. Previous discussions have suggested that non-tuna PPMUS may be increasing in value and a slight shift in target troll fish may be occurring, especially since the skipjack tuna no longer appear to be as abundant.

Catch rates of yellowfin tuna per trip decreased by 38% following the second highest recorded level in 1996. Yellowfin tuna, although more highly prized than skipjack, are not encountered often and are usually taken incidentally while targeting other species. The very sharp decline in landings(Table 1), and catch rate may be indicative of the current oceanographic conditions caused by El Nino.

Source and Calculation: Data were summarized from the Commercial Purchase Data Base, which provides average pounds caught per trip. Annual catch rates for selected species were obtained by calculating the average weight per trip for each year. Trips were assumed to be one day in length and each commercial invoice represents one trip.

Year	Trolling Catch Rate (lb/trip)	
	Skipjack	Yellowfin
1983	104.21	12.09
1984	142.40	9.59
1985	109.75	7.71
1986	150.07	9.98
1987	129.33	8.37
1988	163.25	9.42
1989	162.08	6.36
1990	130.55	9.20
1991	92.46	10.41
1992	45.47	14.25
1993	56.48	8.65
1994	60.42	8.68
1995	61.04	9.74
1996	58.63	13.49
1997	52.09	8.36
Average	101.22	9.75
Standard Deviation	43.14	2.11

Appendix 5

International

The areas administered by the Council are surrounded by large and diverse fisheries targeting pelagic species. This report summarizes information on the reported 1996 catches of pelagic species in the Pacific Ocean between 20° S and 40° N by fleets of various nations. The information was assembled from several sources:

- Data on the geographic distribution of catch and effort by the United States purse seine fleet were supplied by the National Marine Fisheries Service Southwest Region from data reported under terms of the United States and Pacific Island multilateral fishing treaty.
- Data on the geographic distribution of catches, aggregated by 5° degree geographic square, gear type and month, between 20° S and 40° N in the western Pacific were supplied by the Secretariat of the Pacific Community (SPC, formerly the South Pacific Commission) under the terms of a special request from the WPRFMC.
- Data on the geographic distribution of catches, aggregated by 5° degree geographic square, gear type and quarter, in the Eastern Tropical Pacific were supplied by the Inter-American Tropical Tuna Commission.

Caveats and general interpretations.

- This report was assembled from a variety of sources. There is no general consistency between sources in units of reporting or in geographic conventions, nor is the extent of coverage by fleet and geographic area always clear.
- All data are "second hand", and therefore it is impossible to verify their accuracy. At best, it is possible to state that the tables and figures reported here accurately reflect the data as supplied.
- Much of the data on which this report are based were compiled in mid 1997 and it is likely that estimates of 1996 catch may be based on incomplete data.
- In some cases, catch in numbers or "pieces" have been converted to weight by the agency that supplied the data using conversion factors of unknown accuracy.
- The 5° resolution of the catch distribution maps occasionally gives the impression that fishing has occurred within an EEZ when it fact the fishing occurred in the 5° square that contains the boundary of the EEZ.

Status of Stocks.

In 1997, the Standing Committee on Tunas and Billfish (SCTB) was reorganized and several species research groups were created. The Western Pacific Yellowfin Tuna Research Group and the South Pacific Albacore Research Group were reconstituted as species research groups within the general framework of the SCTB. Research groups for skipjack, bigeye, and billfish and by-catch were also convened. The revised SCTB met

in Honolulu, 28 May – 6 June 1998 and reviewed the current status of pelagic fisheries and the condition the major stocks in the central and western Pacific.

In general there was little change to report over the last year in the condition of the major stocks. The estimated Pacific-wide catch combined of skipjack, yellowfin, bigeye and albacore has remained relatively constant at about 1.9 million metric tonnes since 1990. Year to year variation in the relative catch of different species is generally attributed to changes in fishing practices. *Exploitation of most species is considered to be light or moderate.*

However, the status of the Pacific-wide bigeye stock is uncertain. Declining longline CPUE in the Eastern Tropical Pacific suggest that the bigeye population may be in decline. Increasing catches of juvenile bigeye by surface fisheries throughout the Pacific may exacerbate the decline in longline catches. However, the results of the assessment models are highly dependent on assumptions about natural mortality, and the results of attempts to compute indices of abundance from longline CPUE are highly dependent on assumptions about temperature and depth preferences. Further research on bigeye population dynamics is a high priority.

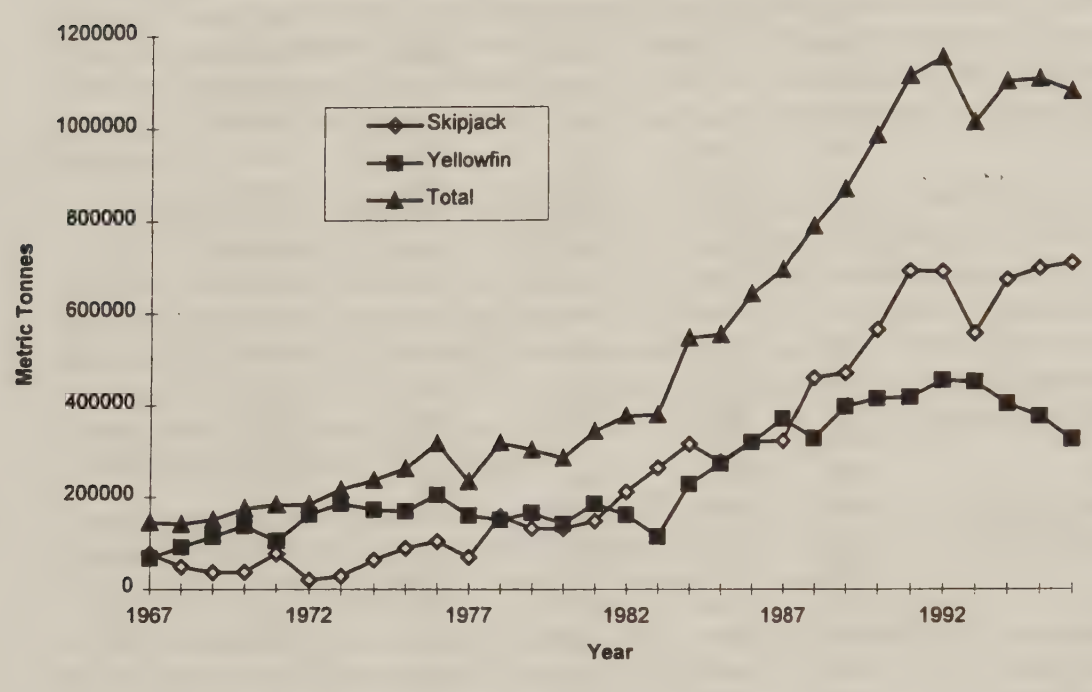
Preliminary results from the assessment model currently underdevelopment at the Secretariat of the Pacific Community with PFRP support suggest that it will be possible to estimate trends in yellowfin biomass within the next year.

Acknowledgments. Dr. John Sibert, manager of the Pelagic Fisheries Research Program at the University of Hawaii, coordinated preparation of this report. Ms. Dodie Lau of the PFRP prepared the figures, tables and maps. Mr. Johnoel Ancheta of the PFRP and Mr. Kevin Weng of the Department of Oceanography, University of Hawaii assisted in manipulating the data files and in preparation of the report. Thanks to Mr. Tim Lawson of the SPC, Mr. Michael Hinton of the IATTC, and Mr. Charles Karnella of NMFS for responding to requests for information.

Table 1. Total reported purse seine catch of bigeye, skipjack and yellowfin tuna, in metric tonnes (SPC + IATTC data).

Year	Bigeye	Skipjack	Yellowfin	Total
1967	863	76772	66913	144548
1968	1453	48499	91254	141206
1969	363	36364	113835	150562
1970	172	36721	137548	174441
1971	1774	76390	104712	182876
1972	2033	19633	161608	183274
1973	2065	28239	185234	215537
1974	806	63040	171889	235734
1975	3835	88019	168544	260399
1976	7896	103568	204205	315669
1977	5135	68344	159076	232555
1978	9483	157631	149637	316751
1979	5095	131551	164905	301551
1980	12327	130342	140910	283579
1981	9232	147071	184768	341071
1982	4419	210072	160723	375214
1983	1784	261862	113268	376914
1984	4140	313101	226209	543450
1985	3767	275309	270735	549811
1986	2447	317791	317593	637831
1987	2005	320311	367806	690123
1988	1185	456329	325958	783472
1989	2353	466852	393778	862982
1990	6998	559297	411198	977493
1991	5231	686215	413720	1105165
1992	8015	684821	450407	1143244
1993	6697	550528	446856	1004082
1994	24630	666607	399474	1090711
1995	32072	690447	372470	1094989
1996	**45171**	**701002**	**322040**	**1068213**
Average	7115	279091	239909	526115
Std Deviation	9974	240232	120820	357799

Figure 1. Total purse seine catch of skipjack and yellowfin tuna (SPC + IATTC data).



Data

Data are aggregated from geographical summaries supplied by the SPC and IATTC. Fleets included are from Australia, Federated States of Micronesia, Indonesia, Japan, Kiribati, Korea, Mexico, New Zealand, Papua New Guinea, Philippines, Russia, Solomon Islands, Taiwan, United States, and Vanuatu.

Interpretation

The steady increase in purse seine catches that began in the late 1970s appears to have halted and catches have been relatively constant since 1993. Yellowfin catches have not increased substantially since their maximum in 1993 due to changes in targeting by the purse seine fleets. The general leveling of catches since 1993 is usually attributed to a leveling of fishing effort due to a lack of demand for canned tuna products.

Figure 2. Distribution of total purse seine skipjack catch in 1996 by 5° geographic square.

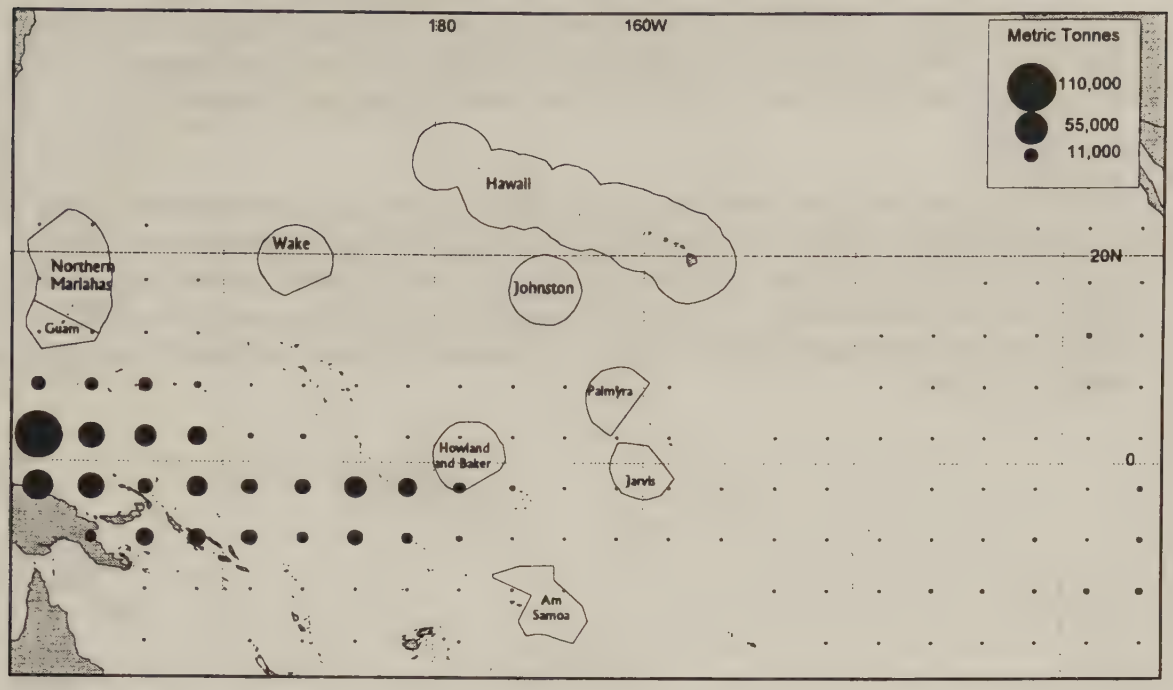
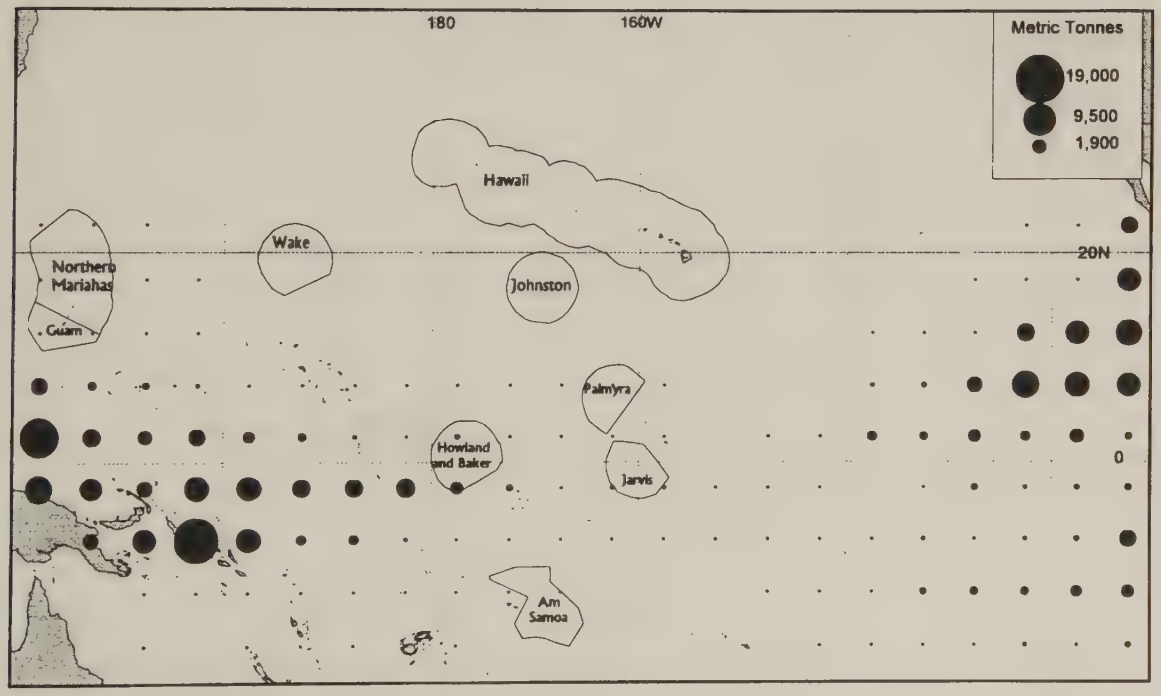


Figure 3. Distribution of total purse seine yellowfin catch in 1996 by 5° geographic square.



Data

Data were supplied by the SPC and IATTC. Data are aggregated by 5° degree geographic square. Fleets included are from Australia, Federated States of Micronesia, Indonesia, Japan, Kiribati, Korea, Mexico, New Zealand, Papua New Guinea, Philippines, Russia, Solomon Islands, Taiwan, United States, and Vanuatu.

Interpretation

Skipjack and yellowfin are important components of purse seine catches in the highly productive fishing grounds in the equatorial western Pacific, principally in the EEZs of Papua New Guinea, Federated States of Micronesia, and Kiribati. Yellowfin dominate catches in the eastern Pacific. The extent of fishing activity in the western Pacific depends on the existence of bilateral fishing agreements between the Island States and the various DWFNs.

Figure 4. Distribution of United States purse seine effort in **1997** by 5° geographic square.

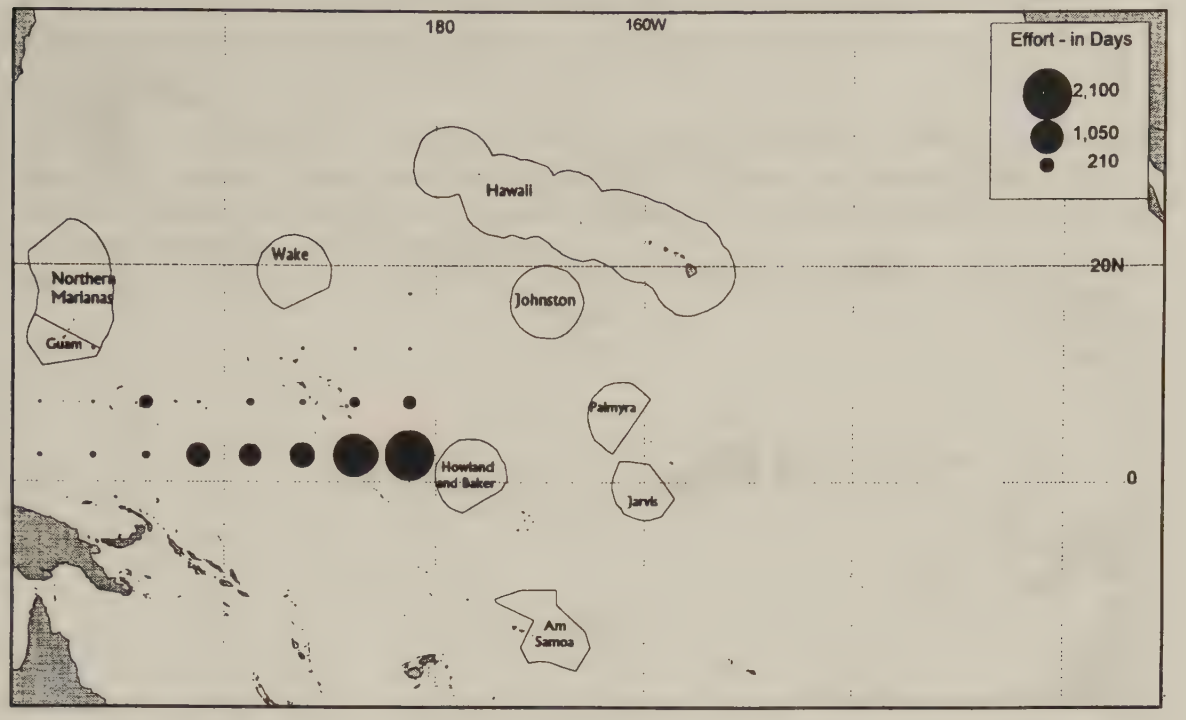


Figure 5. Distribution of United States purse seine catch of skipjack in **1997** by 5° geographic square.

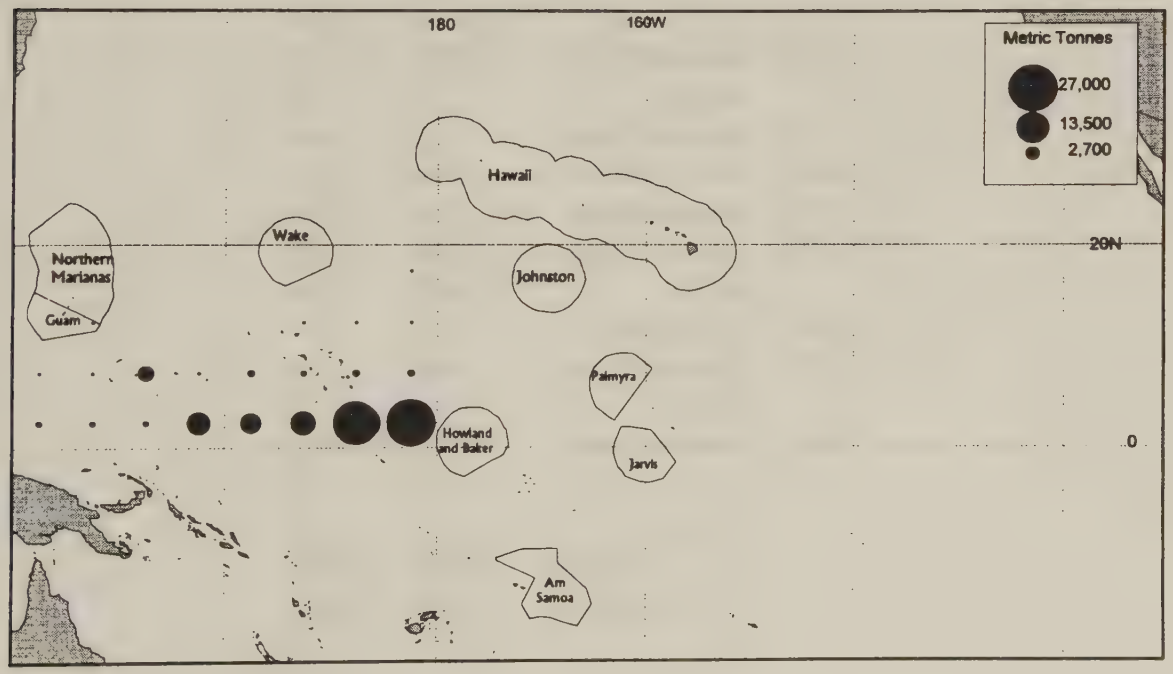


Figure 6. Distribution of United States purse seine catch of yellowfin tuna in **1997** by 5° geographic square. (Reported yellowfin catch includes an unknown proportion of bigeye tuna.).

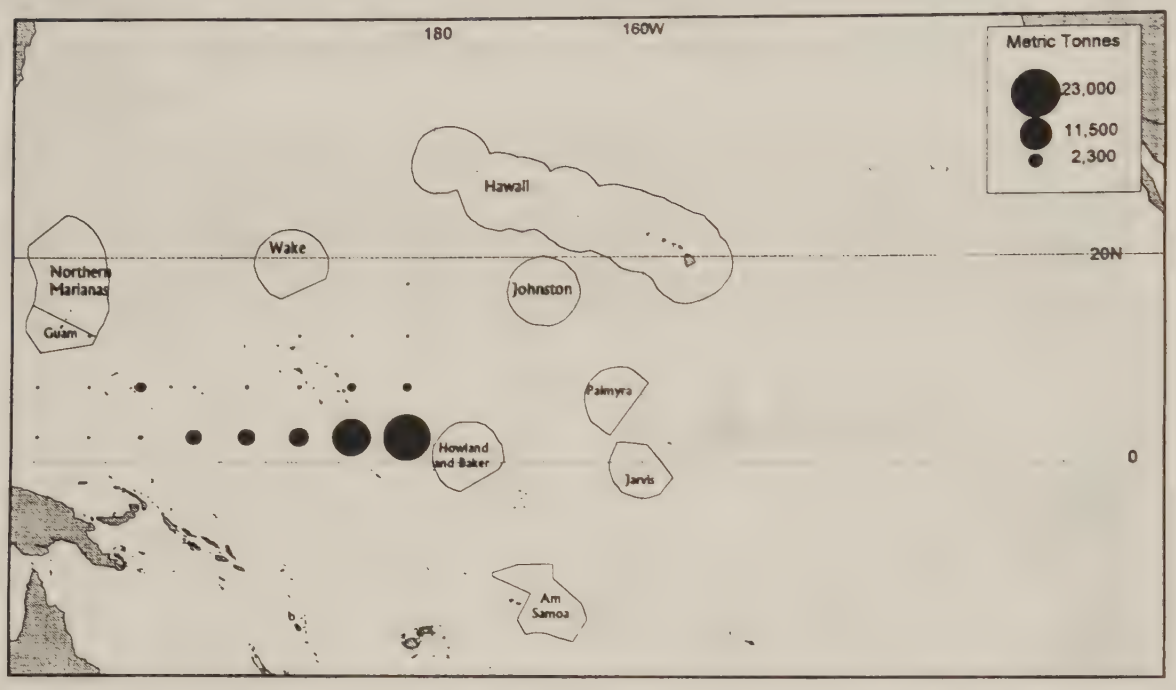


Table 2. United States purse seine tuna catches in U.S. EEZs in metric tonnes. (Yellowfin catch includes bigeye.)

Year	Country	Yellowfin	Skipjack
1990	Howland/Baker	18929	22718
	Palmyra	0	767
1991	Howland/Baker	55	3638
1992	Howland/Baker	6706	22143
1993	Howland/Baker	2743	25075
1994	Howland/Baker	6206	25721
	Jarvis	20430	9354
1995	Howland/Baker	71	959
1996	Howland/Baker	862	2938
	Palmyra	92	377
1997	Howland/Baker	12725	16964
	Jarvis	2559	4342
	Palmyra	23	41
	Average	5492	10387
	Std Deviation	7324	10455

Data

Data were supplied by the National Marine Fisheries, Pacific Islands Area Office from data reported under terms of the United States and Pacific Island multilateral fishing treaty.

Interpretation

The bulk of US purse seine activity occurs in the highly productive fishing grounds in the equatorial western Pacific, principally in the EEZs of Papua New Guinea, Federated States of Micronesia and Kiribati. There is sporadic activity in the US EEZ surrounding Howland, Baker, Jarvis and Palmyra islands.

Table 3 Total western Pacific longline catch of PMUS 1962-1996 in metric tonnes.

Year	Albacore	Bigeye	Bluefin	Yellowfin	Black Marlin	Blue Marlin	Sword fish	Striped Marlin	Total
1962	43835	71926	2429	75283	1375	23214	13494	18517	250072
1963	27111	67155	1677	56583	946	16340	9960	14997	194770
1964	21976	46113	814	49239	792	12024	7053	31527	169537
1965	17758	38827	659	45985	1176	9186	8252	24601	146445
1966	26794	38730	341	53723	1038	8660	9233	15611	154131
1967	34932	42199	250	29308	623	7889	9989	22100	147291
1968	29393	34500	191	35624	469	6684	8733	28212	143806
1969	21740	43306	114	38498	626	7916	8201	16306	136709
1970	23502	36990	91	37918	560	10531	6388	28248	144228
1971	17891	34227	76	34488	610	6128	6561	22660	122641
1972	18440	45832	50	37281	538	7292	5977	13662	129073
1973	18767	38632	103	38040	492	7289	6177	13530	123030
1974	13965	39148	29	35208	367	6904	5847	14221	115689
1975	13933	38708	24	30984	253	4546	6587	10000	105036
1976	23020	68261	66	52767	216	6216	8509	11073	170129
1977	26028	76342	92	65948	283	6459	8329	5715	189196
1978	23770	61327	164	76844	352	7482	7999	5836	183774
1979	20984	70189	159	73370	456	7655	8663	10041	191518
1980	24456	73471	51	100765	854	8766	9624	12648	230635
1981	33383	64087	175	69438	761	9564	13094	12779	203280
1982	26710	69760	131	65015	828	9597	10505	12704	195250
1983	21475	60245	45	64073	642	7134	11644	8309	173567
1984	23001	70179	44	49972	759	10453	9494	8089	171990
1985	21867	88504	27	60228	698	8808	11719	8920	200772
1986	18332	104497	15	58393	483	10030	12248	12785	216784
1987	20284	109351	69	51967	743	10262	14036	14049	220761
1988	24448	90741	45	59886	1174	10869	13462	14980	215605
1989	15563	87070	40	50343	730	8962	11097	10443	184248
1990	20546	101918	37	65038	1123	8258	10221	6067	213209
1991	23221	99200	37	52671	981	8987	11921	7626	204644
1992	21709	94729	201	51659	940	7991	12946	6989	197164
1993	30846	95445	262	52935	1248	10443	23921	9384	224483
1994	35992	91328	245	62923	937	12024	11616	8925	223990
1995	47288	74465	145	56719	729	11562	10916	11450	213276
1996	**28719**	**57437**	**109**	**52401**	**497**	**9831**	**7805**	**11081**	**167881**
Ave.	24619	66424	257	54043	723	9313	10063	13831	179275
S.D.	7484	23342	487	15172	294	3259	3385	6636	37224

Data

Data are aggregated from geographical summaries supplied by the SPC. Fleets included are from American Samoa, Australia, China, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Japan, Korea, Marshall Islands, New Caledonia, New Zealand, Papua New Guinea, Solomon Islands, Tonga, Taiwan, United States, and Western Samoa. Longline catch is reported to the SPC in "pieces" and converted to weight (metric tons) using average weight estimates for each species.

Figure 7. Longline tuna catches, 1962-1996.

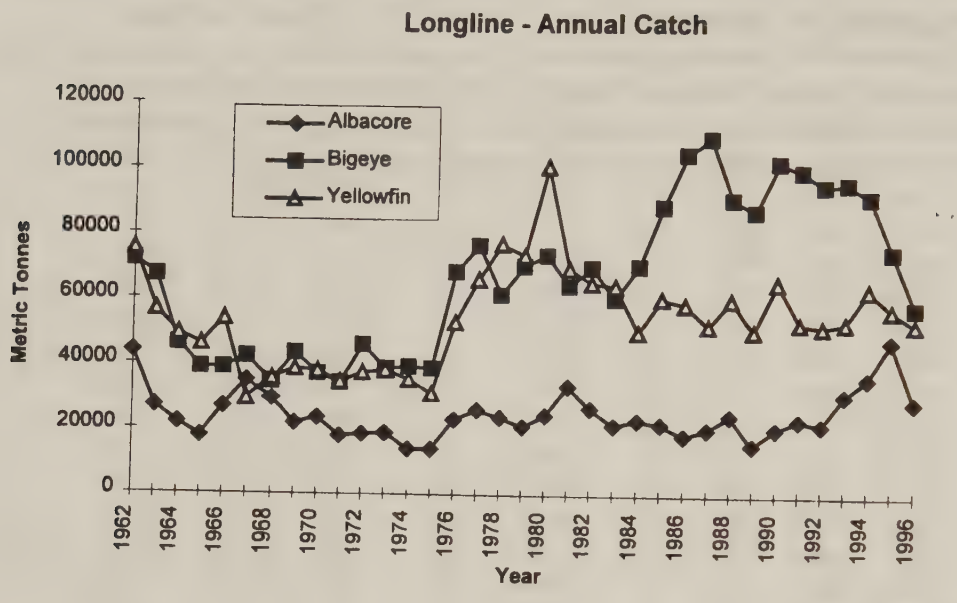


Figure 8. Distribution of longline catches of all tuna species in 1996.

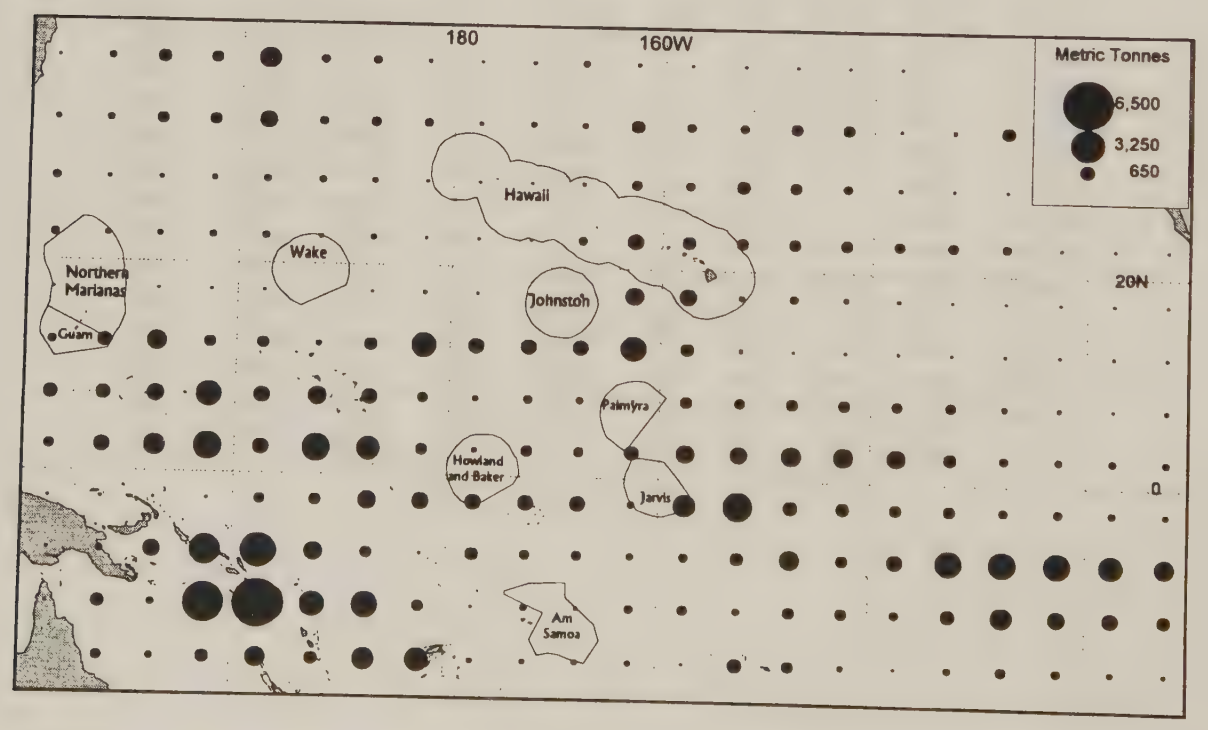


Figure 9. Distribution of longline catches of yellowfin tuna in 1996.

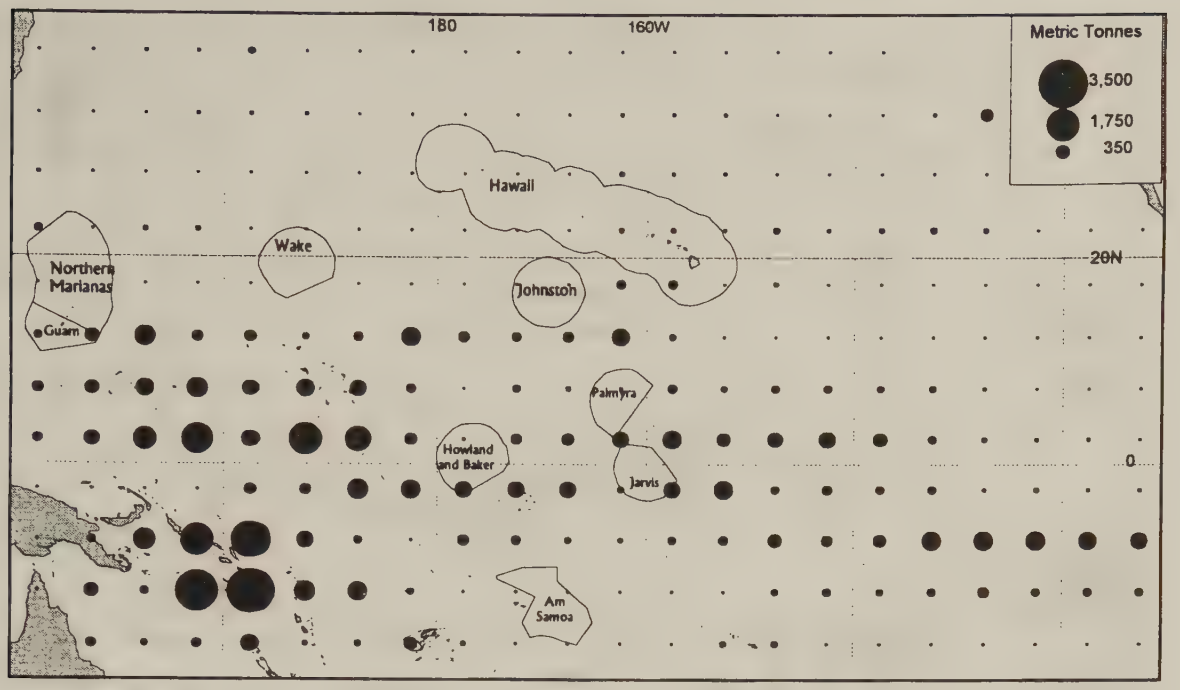


Figure 10. Distribution of longline catches of bigeye tuna in 1996.

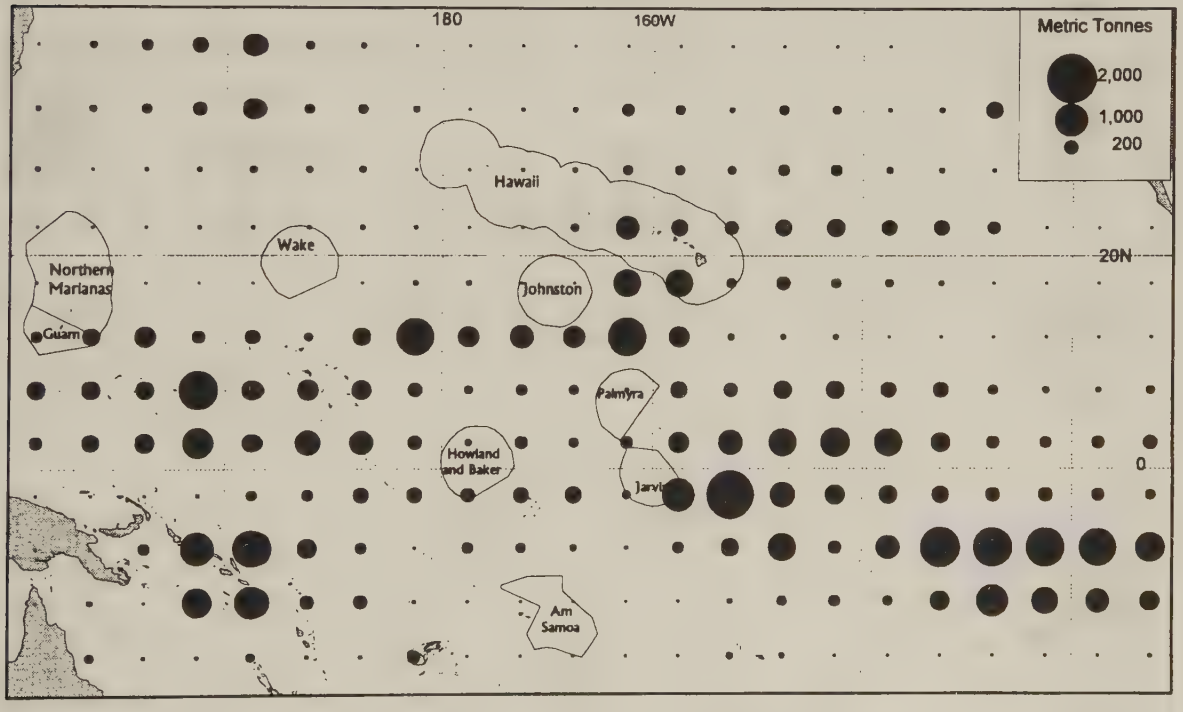


Figure 11. Distribution of longline catches of albacore tuna in 1996.

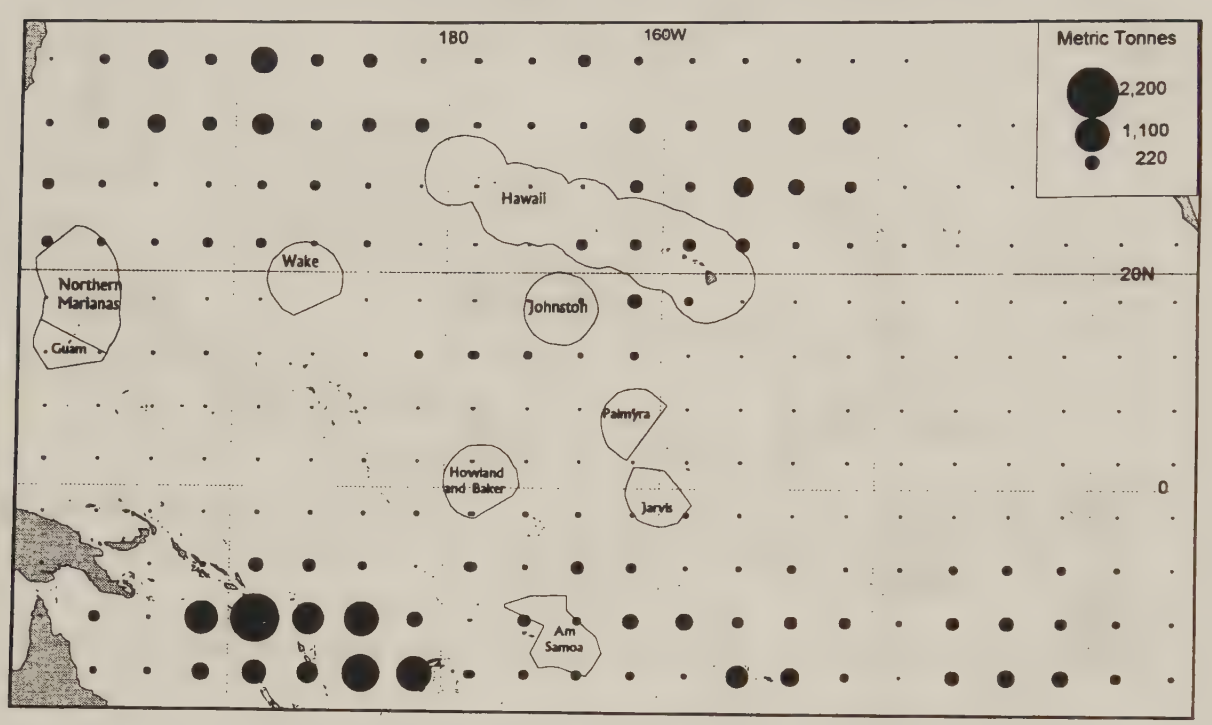


Figure 12. Distribution of longline catches of bluefin tuna in 1996.

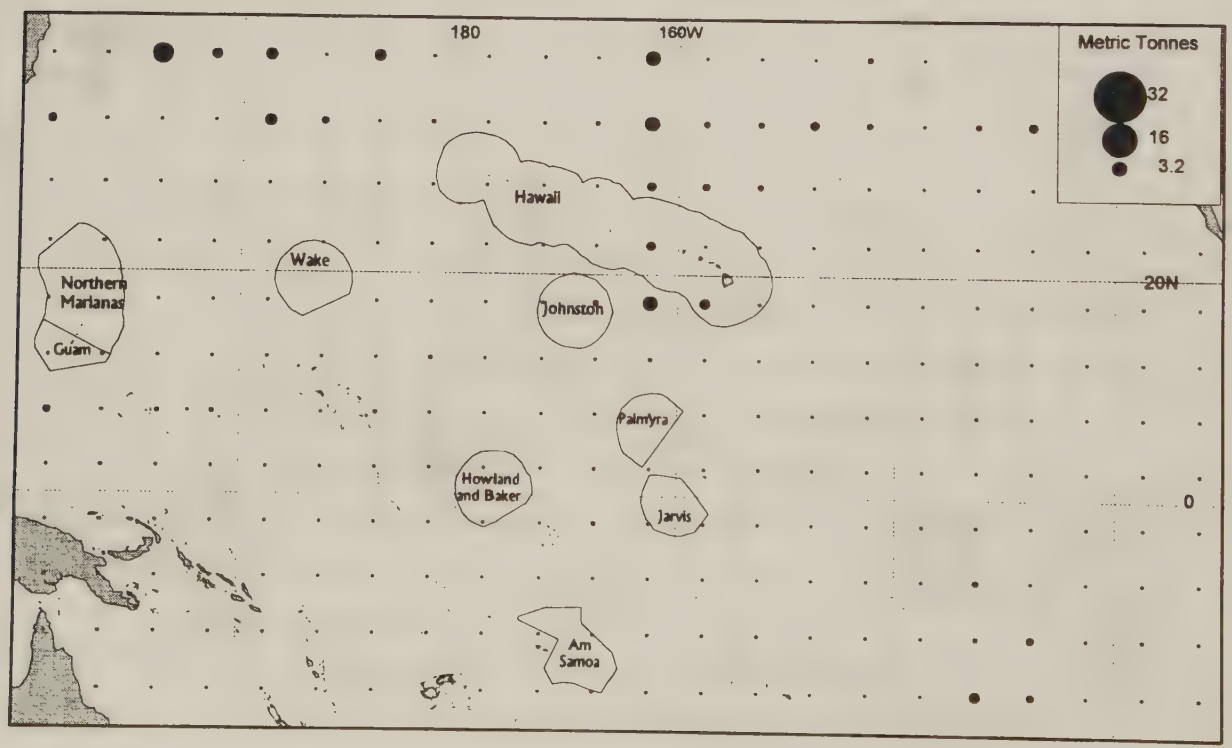


Figure 13. Longline billfish catches in the SPC Statistical Area, 1962-1996.

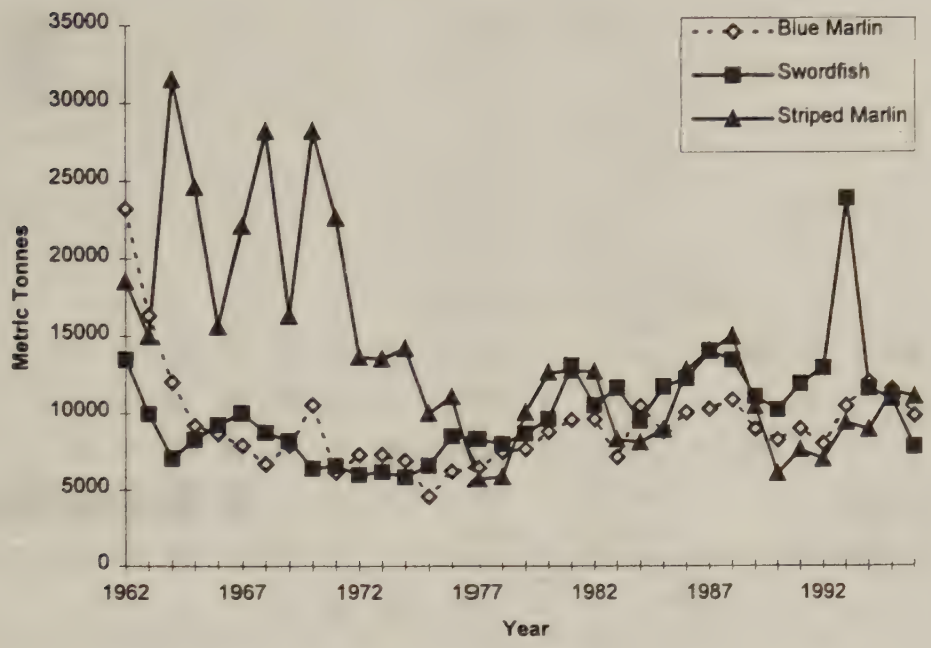


Figure 14. Distribution of longline catches of swordfish in 1996.

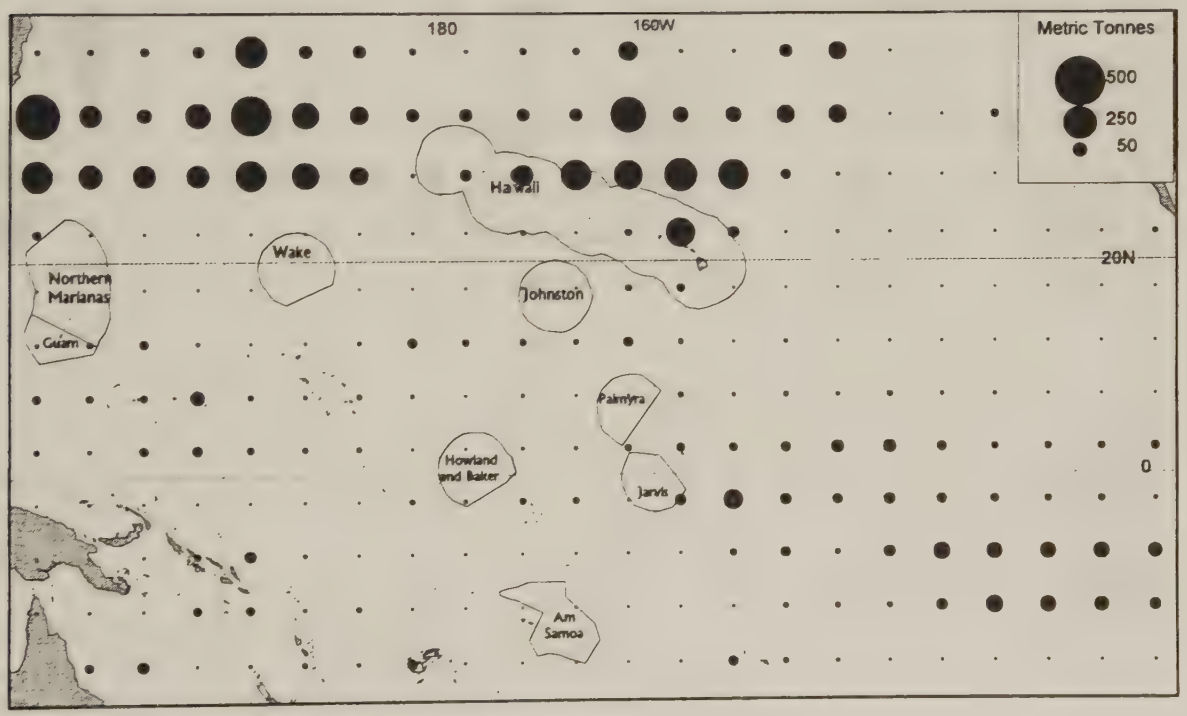


Figure 15. Distribution of longline catches of blue marlin in 1996.

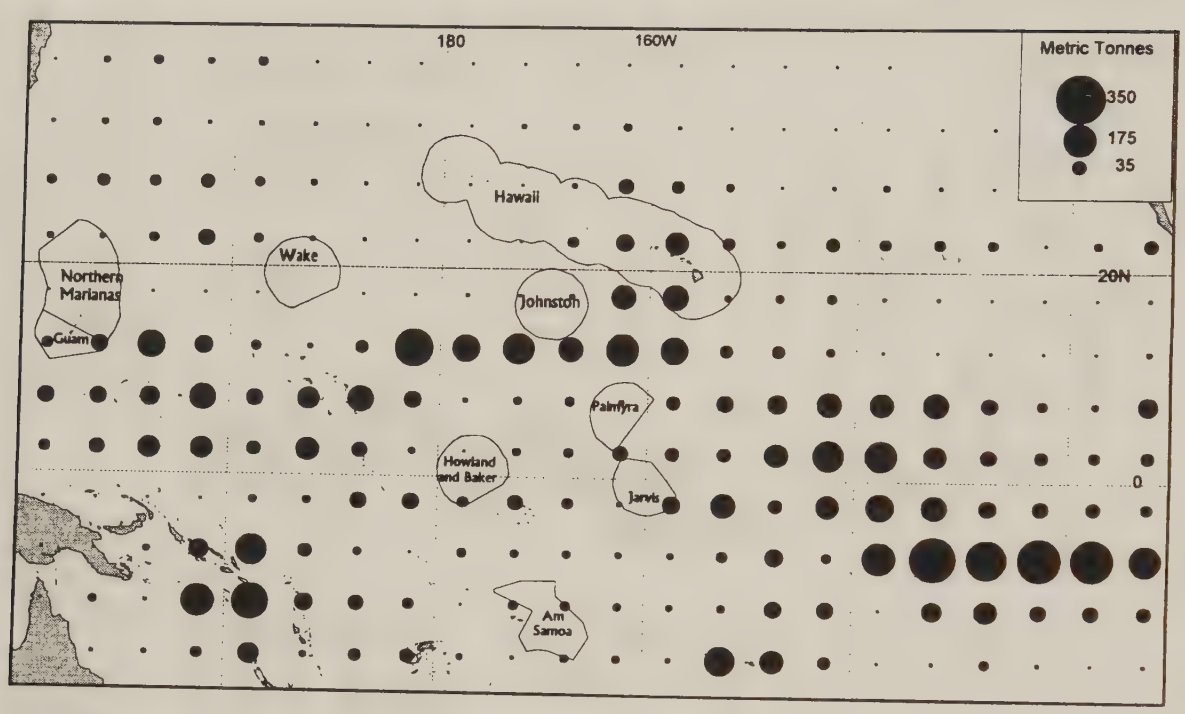


Figure 16. Distribution of longline catches of striped marlin in 1996.

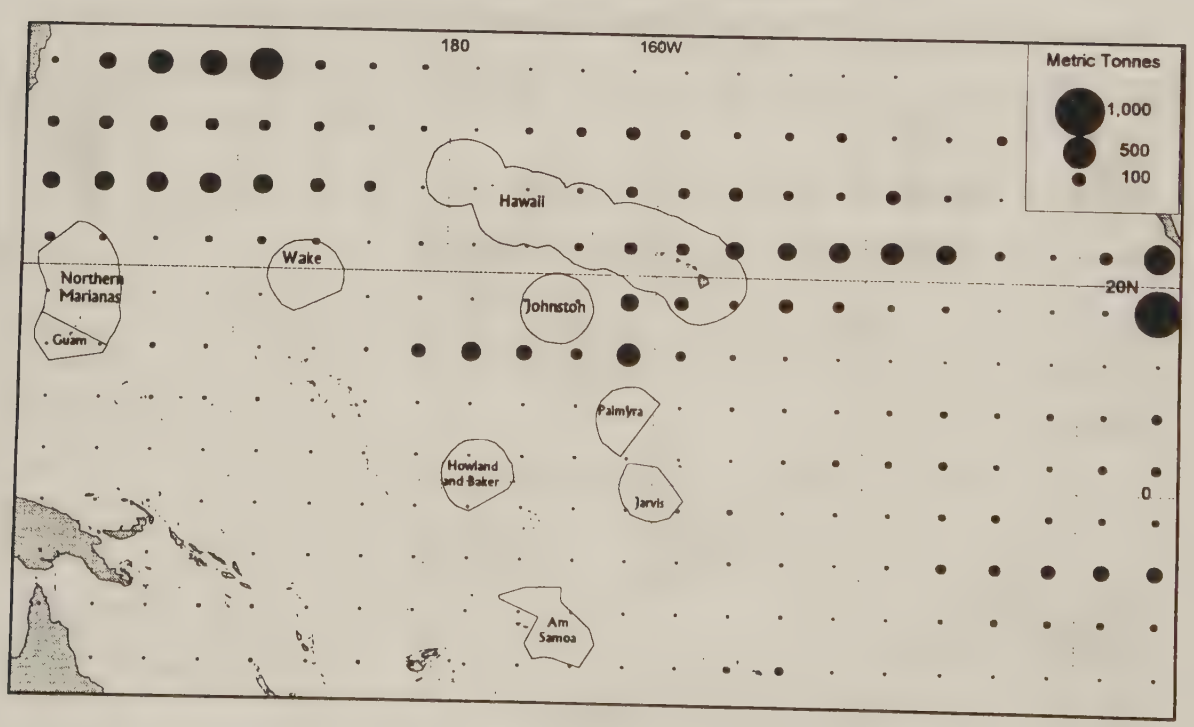


Table 4. Total western Pacific pole and line catch of skipjack 1970 - 1996 in metric tonnes.

Year	Skipjack
1970	2354
1971	16862
1972	151422
1973	236306
1974	258881
1975	196472
1976	245833
1977	266908
1978	285698
1979	237704
1980	267690
1981	254863
1982	220561
1983	255941
1984	321323
1985	192967
1986	275216
1987	204959
1988	233183
1989	210266
1990	138484
1991	192418
1992	145660
1993	63333
1994	63747
1995	76673
1996	**62331**
Ave.	188076
S.D.	88201

Figure 17. Total western Pacific pole and line catch of skipjack 1972 -1996 in metric tonnes.

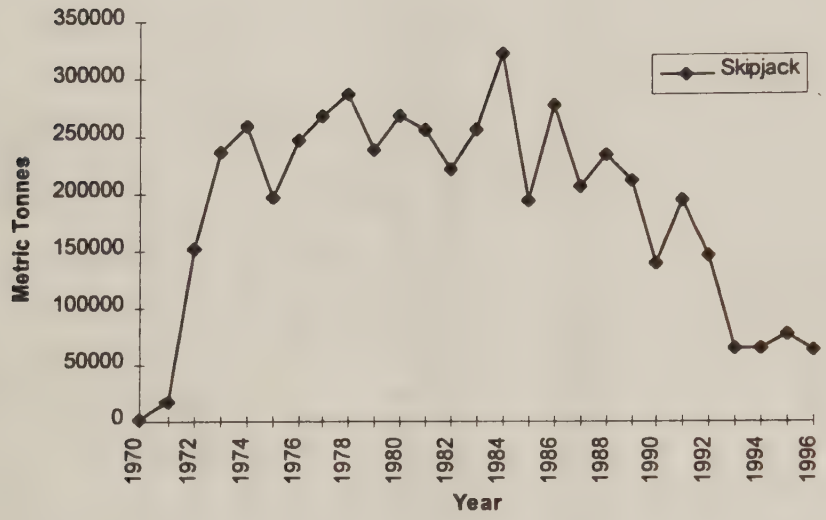
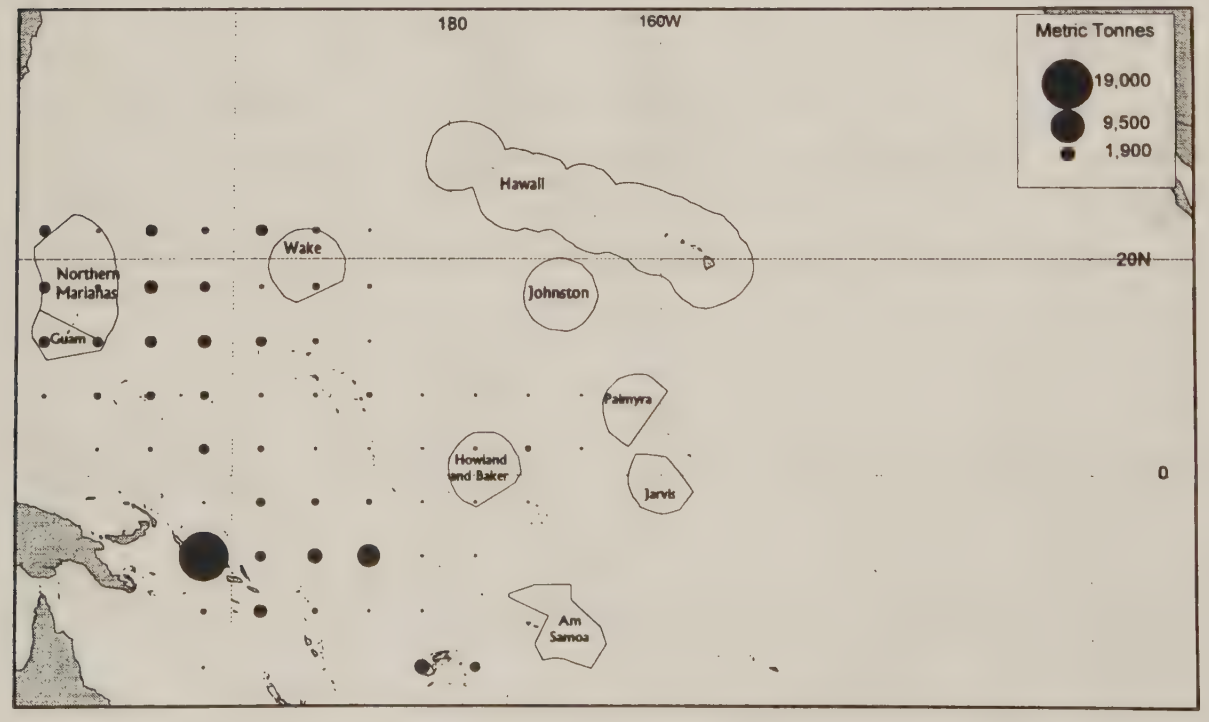


Figure 18. Distribution of pole and line catch of skipjack in 1996 by 5° geographic square in the western Pacific.



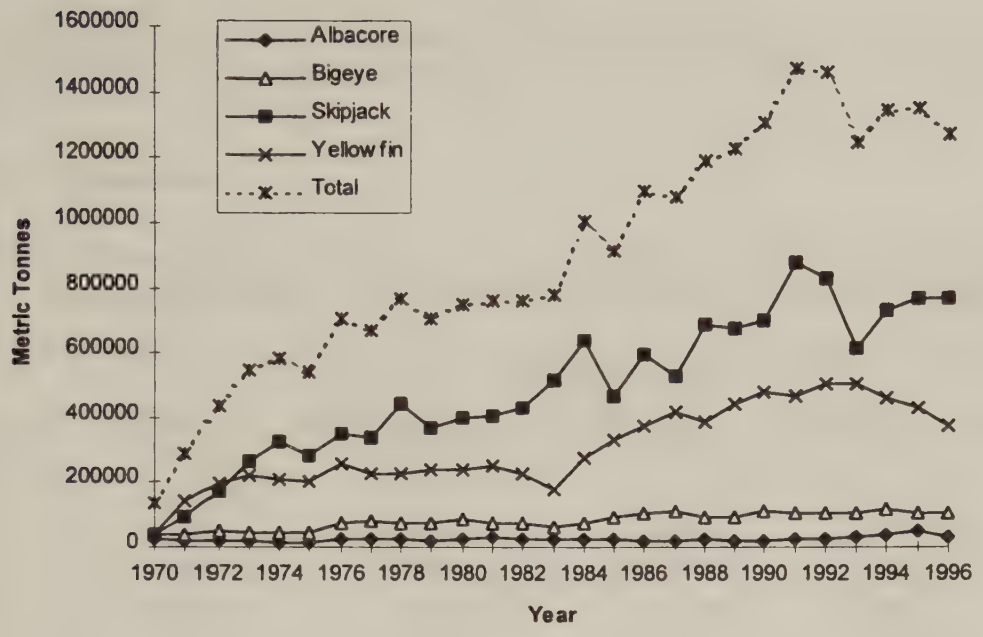
Data

All data on pole and line landing were supplied by the SPC. Fleets included are from Australia, Fiji, French Polynesia, Japan, Kiribati, New Caledonia, Palau, Papua New Guinea, Solomon Islands, and Tuvalu. Catch statistics for the Japanese pole and line fleet for 1995 and 1996 are incomplete and "catch estimates for 1994 have been used as preliminary estimates for 1995 and 1996" in the 1996 SPC Tuna Fishery Yearbook.

Table 5. Estimated annual catch of tuna species in the Pacific between 20° S and 40° N, in metric tonnes.

Year	Albacore	Bigeye	Skipjack	Yellowfin	Total
1970	23502	37162	39093	38116	137874
1971	17891	36001	93253	139200	286345
1972	18440	47865	171055	198889	436249
1973	18767	40697	264545	223274	547283
1974	13965	39954	321920	207097	582936
1975	13933	42543	284505	199528	540510
1976	23020	76158	349578	256972	705728
1977	26028	81476	335382	225024	667910
1978	23770	70810	443552	226481	764613
1979	20984	75284	369416	238275	703959
1980	24456	85797	398114	241675	750042
1981	33383	73319	402085	254206	762993
1982	26710	74179	430801	225738	757429
1983	21475	62029	517897	177341	778742
1984	23001	74319	634487	276181	1007988
1985	21867	92271	468322	330964	913424
1986	18332	106944	593054	375987	1094317
1987	20284	111357	525301	419774	1076716
1988	24448	91926	689550	385844	1191768
1989	15563	89423	677154	444121	1226261
1990	20546	108916	697809	476236	1303508
1991	23221	104430	878650	466391	1472692
1992	21709	102745	830571	502066	1457091
1993	30846	102142	613973	499791	1246752
1994	35992	115958	730725	462397	1345073
1995	47288	106538	767565	429189	1350580
1996	**28719**	**102608**	**763566**	**374441**	**1269335**
Ave.	23635	79735	492293	307230	902893
S.D.	7089	25558	224283	125345	365975

Figure 19. Estimated total annual catch of tuna species in the Pacific between 20° S and 40° N, in metric tonnes.



Appendix 6

Pelagic fisheries production from the Pacific West Coast States

Introduction

This is the first occasion on which the Council's pelagics annual report has featured data for pelagic fisheries production along the US Pacific coast. It will continue to be a feature of this report in the future.

Data and interpretation[1]

Table 1. Annual landings of pelagic fish in the Pacific West Coast States (Washington, Oregon, California). Source: Pacific States Marine Fisheries Commission

Year	Roundweight (lbs)				
	Albacore	Skipjack Tuna	Yellowfin Tuna	Swordfish	Bluefin Tuna
1981	30,230,451	127,578,862	167,750,792	1,651,992	1,912,748
1982	11,926,678	92,382,129	136,176,589	2,451,637	5,300,917
1983	21,003,010	99,196,813	122,885,518	3,874,961	1,683,346
1984	27,904,422	68,896,983	77,299,371	6,370,253	1,400,998
1985	16,096,156	6,562,190	33,123,315	7,535,193	7,173,304
1986	11,558,766	3,000,357	47,436,520	5,576,601	10,431,044
1987	6,965,463	12,619,100	51,149,000	3,974,472	1,814,054
1988	10,808,348	19,539,462	43,033,185	3,606,286	1,771,706
1989	3,477,247	9,932,415	38,834,234	4,147,937	2,246,122
1990	5,104,985	4,972,703	18,759,201	2,724,103	2,040,073
1991	3,426,538	7,511,845	9,209,749	2,269,172	228,908
1992	10,691,048	5,700,863	7,384,581	3,407,317	2,396,583
1993	13,369,501	10,006,587	8,366,225	3,903,422	1,231,922
1994	21,792,913	4,653,975	11,145,828	3,747,139	2,018,826
1995	13,279,775	15,513,703	6,698,483	2,554,458	1,573,689
1996	30,798,481	12,025,385	7,378,056	2,560,987	10,332,284
1997	24,686,453	13,381,602	10,524,194	2,725,792	4,959,072

The steady declines in yellowfin and skipjack landings through the early 1980s were due to combinations of events, namely overfishing (on yellowfin, but not skipjack), the El Niño event of 1982-1983, and U.S. regulations for the protection of marine mammals. Heavy exploitation of small yellowfin during the late 1970s reduced the abundance of yellowfin in the Eastern Pacific Ocean (EPO),

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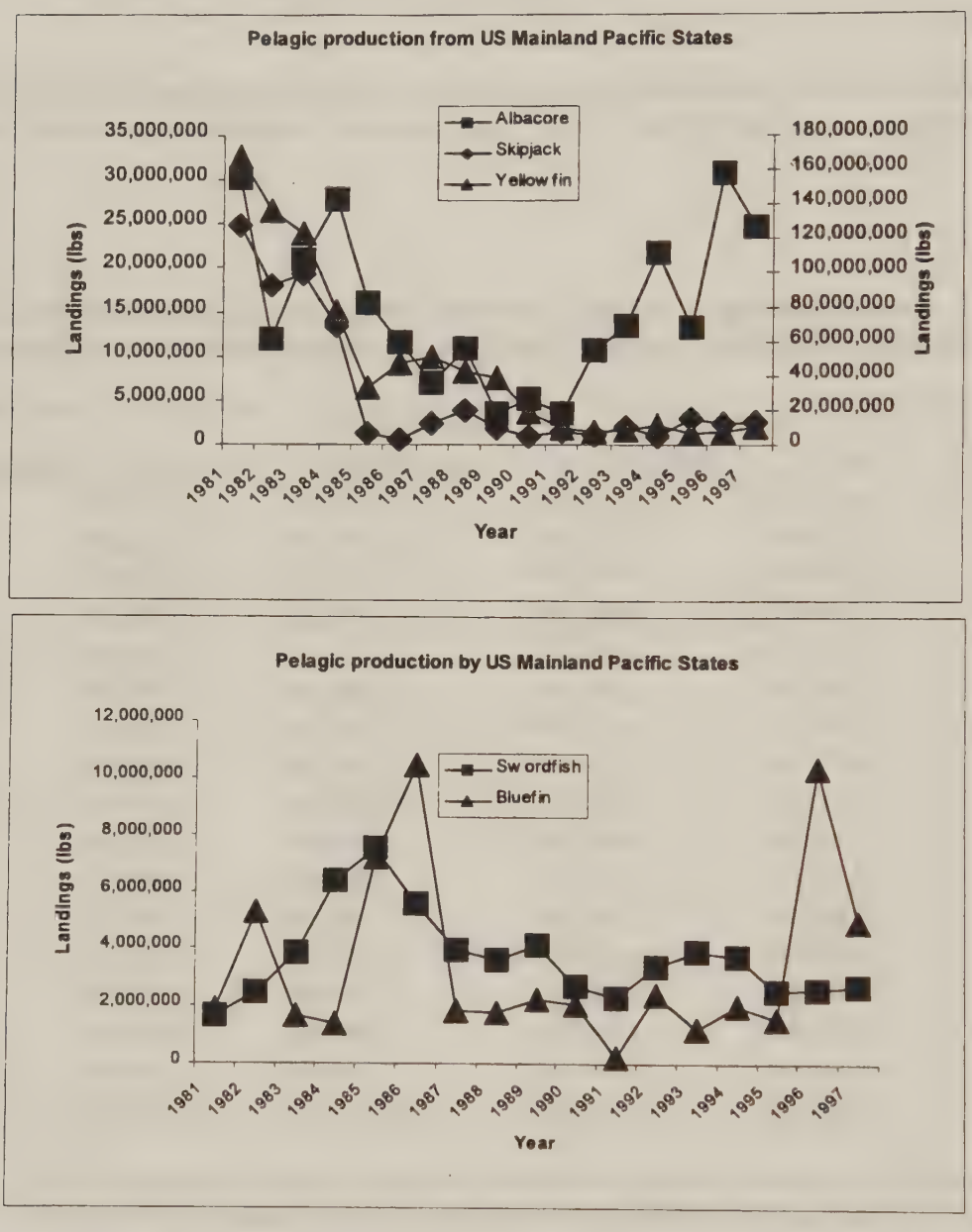
[1]. N. Bartoo, NMFS SWFSC and W. Bayliff, IATTC, *personal communications*, and Annual Report of the Inter-American Tropical Tuna Commission, 1996. IATTC, La Jolla, 301 pp.

Figure 1. Landings of pelagic fish in the Pacific West Coast States of Washington, Oregon and California, 1981-1997



and then the El Niño event of 1982-1983 made the fish harder to catch. As a result, a large portion of the U.S. fleet transferred to the western Pacific. The low catches of yellowfin during the early and mid 1980s permitted the abundance of yellowfin to increase, and the vessels of the reduced fleet experienced much greater CPUEs. However, it was becoming more and more difficult for vessels registered in countries other than the United States to export their fish to the United States because of increasingly strict regulations to protect marine mammals. Eventually the U.S.-flag vessels couldn't set on dolphin-associated schools of tunas. As a consequence, all but one of the canneries in Southern

California were closed during the late 1980s and early 1990s.

Bluefin tuna catches over the past two decades have shown strong fluctuations, with peaks in 1985 and 1996. According to the IATTC the poor performance of the fishery, which comprises small U.S. purse seiners which unload their catches in California, may be due to several factors. These include a decrease in recruitment; a decrease in the overall abundance of fish greater than about 60 cm in length caused by heavy exploitation of fish during their first year of life in the Western Pacific Ocean (WPO), reduced fishing effort in the EPO; a decrease in the vulnerability to capture of fish which have migrated to the EPO; and/or a decrease in the availability of bluefin in the EPO. Results from the analysis of catch at age and tagging data suggest that variations in the proportions of fish which migrate from the WPO to the EPO are at least partly responsible for variations in catches in the EPO.

US-based fisheries for swordfish in the EPO include both harpooners and gillnetters, with the largest fraction of the catch coming from gillnetters. The gillnet fishery was originally directed at sharks but is now directed seasonally at swordfish, Landings of swordfish on the US Pacific coast have declined gradually from the mid-1980s onwards, mainly as a result of decreased fishing effort, matching a general trend for swordfish production in the EPO, largely as a result of effort decreases.

The peak of the West Coast albacore fishery was in the early 1970's (not shown in Figure 2), peaking Pacific-wide at 100,000 plus mt annually. Prior to this the US fishery had relatively steady production of around 20,000 mt since the late 1950's. In 1971-2 the Japanese pole-and-line fleet underwent a dramatic expansion offshore, near the Emperor Seamount, increasing their catches by 100% or more. There appeared to be a cooler climatic regime in the early 70's (prior to 1976) and there were substantial nearshore albacore catches. An apparent decade-scale climate shift in 1976 reulted in lower albacore productivity (or availability). The catches taken from the whole stock during the peak years were at, or slightly above MSY; this combined with a lowering of productivity in the late 1970's (and a lower MSY) caused catch rates to drop in the US and Japanese fisheries. Economics in the US fleet made it hard for smaller, nearshore boats to succeed. The expansion of the US fleet to mid-Pacific in the early 1980's held catches up somewhat for the US, but nearshore was poor. From the late 1970's to about 1990 catch per effort declined along with overall effort in both the US and Japanese pole-and-line fleets. The development of the drift net fisheries in the 1980's reinforced this trend. In about 1990 another climate shift took place and it appears that albacore productivity increased.

These two concomitant events, demise of the gillnets and apparent productivity increase, elevated CPUE and catch back to 1980 levels. The decline from 1980 to 90 was about half of the total decline phase. The catches and CPUE were flat between 1987 to 1991 and then increased with fishing mortality reduction and productivity increase[2].

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2 The quick increase in catches and possible additional catch/effort moving into the fishery now may or may not be sustained. CPUE might be stagnant for the US as other gears take the increased production, most notably longline production by Japan is up by almost 100%.

Appendix 7

New data reporting requirements from revised Magnuson-Steven Fishery Conservation and Management Act

Introduction

The re-authorization of the Magnuson-Steven Fishery Conservation and Management Act (MSFCMA) in 1996 included the addition of National Standard 9, which states: *Conservation and management measures shall to the extent practicable, (A)minimize bycatch; and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.* Bycatch is defined as fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. National Standard 9 means that the Councils and collaborating agencies are charged with the responsibility of establishing standardized reporting methodologies to assess the amount and type of bycatch occurring in a fishery, and to include conservation and management measures that minimized bycatch volume and the mortality of discards.

The re-authorized MSFCMA also stated that Fishery Management Plans must address data reporting on recreational, commercial and charter fisheries as follows: *include a description of the commercial, recreational, and charter fishing sectors which participate in the fishery and, to the extent practicable, quantify trends in landings of the managed fishery resource by the commercial, recreational, and charter fishing sectors.*

During 1997 and 1998, the Council reviewed each of its FMPs and amendments to see where they met the new MSFCMA requirements and where they were deficient[1]. Part of this process included reviewing the data collection systems employed by the Council to generate data on the various FMP fisheries, and whether they currently meet the requirements of the re-authorized MSFCMA, or where they were deficient. A synopsis of these results with respect to the data currently available on pelagic fisheries bycatch, and the production from charter vessels targeting pelagic species is given here. It is likely that in the future this section of the annual report will be expanded as the various data collection programs employed by collaborating agencies such as NMFS and the state and territorial fisheries departments are modified in accordance with the new provisions of the re-authorized MSFCMA.

Bycatch

Information on bycatch in pelagic fisheries within the Council's region is presently only available for the Hawaii longline fishery, and for the US purse seine fleet which fishes in the central and western Pacific. Information on longline bycatch comes from two sources; the logbooks completed by the skippers of the vessels, and from the records of NMFS observers who are

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[1] Magnuson-Stevens Act Definitions and Required Provisions: Amendment 6 to the Bottomfish and Seamount Groundfish Fisheries Management Plan Amendment 8 to the Pelagic Fisheries Management Plan Amendment 10 to the Crustaceans Fisheries Management Plan Amendment 4 to the Precious Corals Fisheries Management Plan. Western Pacific Regional Fishery Management Council, Honolulu.

deployed on the Hawaii longliners primarily to record protected species interactions. The logbook records refer primarily to discards of target species, while observers record discards of all species, including those without little or no market value.

From the logbook data (Table 1), the largest volume of discards are sharks, although over the past decade, increasing amounts of sharks have being retained for finning. Overall, about 25% of the total catch of the longline vessels is currently discarded. The composition of the non-PMUS species is unknown, but observer records suggest that the composition of this fraction of the catch is composed mainly from lancet fish, pelagic stingrays, snake mackerel and escolars (Figure 1). Technically, turtles caught and released by the longliners are also classed as bycatch, as the MSFCMA includes marine reptiles in the definition of 'fish'. However, turtle takes are appropriately addressed under the protected species section of this report (see pages 18-20)

Table 1. Logbook estimates of catch and discards of PMUS by Hawaii-based longline vessels in 1997 (Source: NMFS Honolulu Laboratory)

Species	Number Caught	Number Finned	Number Kept	Number Released	Discards as % of Total Catch
Blue marlin	8249		8032	217	2.63
Spearfish	7302		7028	274	3.75
Striped marlin	12614		11925	689	5.46
Swordfish	39500		38164	1336	3.38
Other billfish	1708		1587	121	7.08
Blue sharks	79712	45,608	217	33,887	42.51
Mako sharks	1164	523	344	297	25.52
Thresher sharks	2321	550	212	1,559	67.17
Other sharks	2326	1769	16	541	23.26
Albacore	71051		66424	4627	6.51
Bigeye	79602		77220	2382	2.99
Bluefin	242		221	21	8.68
Skipjack	12058		11760	298	2.47
Yellowfin	28983		28281	702	2.42
Mahimahi	49311		40995	8316	16.86
Moonfish	8241		8068	173	2.10
Oilfish	1746		637	1109	63.52
Pomfret	10423		10345	78	0.75
Wahoo	8304		8132	172	2.07
Non-PMUS	1152		1073	79	6.86

According to catch report form data compiled by the skippers of purse-seine vessels operating in US EEZ waters in 1997 (Table 2), discards amounted to less than 0.5% of the total volume of catch. Purse-seine logbooks indicate that skipjack tuna forms the largest fraction of the discard volume by weight. This data is confirmed by the weight and numbers of discards recorded by observers aboard US purse seiners operating within the US EEZ waters between 1994 and 1997 (Table 3). Rainbow runner, triggerfish and mackerel also make significant contributions to purse-seine discards in terms of numbers.

Figure 1.Observer estimates of the composition of non-PMUS that may be discarded by the Hawaii longline fishery, 1994–1997 (percent of total number) (Source: NMFS Honolulu Laboratory)

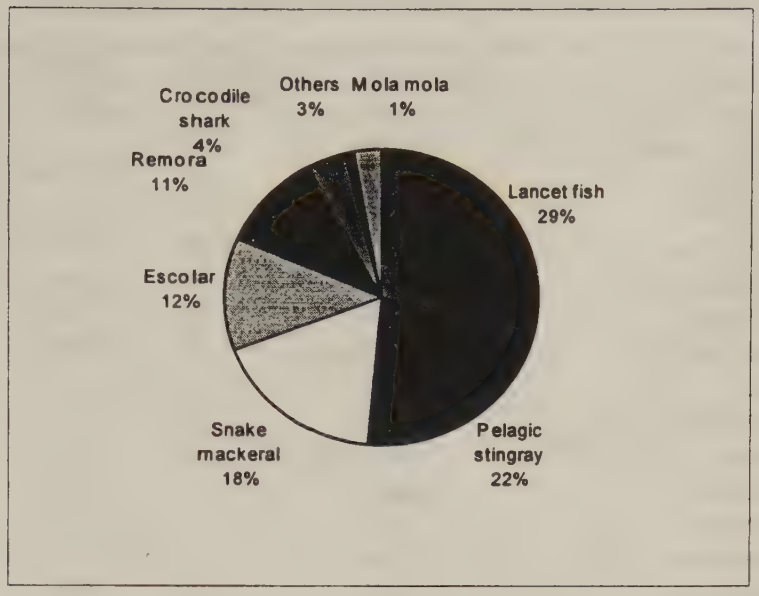


Table 2. Logbook estimates of volume of discards by US purse seiners operating in the EEZ around the uninhabited islands of the Pacific Insular Areas, 1997 (Source: NMFS SW Fisheries Science Center)

Species	Quantity Discarded (mt)				
	Howland & Baker	Jarvis	Palmyra	All Islands	Percent of Total Discards
Skipjack tuna	68.19	18.72	1.00	87.91	63.64
Yellowfin tuna	1.55	1.92		3.47	2.51
Mixed	13.89	1		14.89	10.78
Marlin	3.07	0.7		3.77	2.73
Blue marlin	0.35			0.35	0.25
Sailfish	0.05			0.05	0.04
Swordfish		0.09		0.09	0.07
Shark	9.8	1.79		11.59	8.39
Albacore	0.02			0.02	0.01
"Baitfish"	7.66	0.56		8.22	5.95
Barracuda	0.05			0.05	0.04
Dolphinfish	0.03	0.13		0.16	0.12
Mackerel	0.46	0.52		0.98	0.71
Manta ray	0.15			0.15	0.11
Mixed species		0.07		0.07	0.05
Rainbow Runner	1.02	5.1		6.12	4.43
Wahoo	0.05			0.05	0.04
Unknown species	0.19			0.19	0.14
TOTAL	106.53	30.6	1.00	138.13	100.00

Table 3. Observer estimates of volume of discards by US purse seiners operating in the EEZ around the uninhabited islands of the Pacific Insular Areas, 1994–1997 (Source: Forum Fisheries Agency, Honiara)

Species	Weight (mt)	Numbers	% wt	% no
Skipjack Tuna	124.50	1765	82.33	36.07
Rainbow runner	7.91	1672	5.23	34.17
Triggerfish	2.65	661	1.75	13.51
Mackerel	3.27	365	2.16	7.46
Bigeye Tuna	1.48	149	0.98	3.05
Yellowfin Tuna	7.07	130	4.67	2.66
Mahimahi	0.09	73	0.06	1.49
Black marlin	0.22	14	0.14	0.29
Shark	0.22	14	0.14	0.29
Blue marlin	1.73	12	1.14	0.25
Wahoo	0.00	8	0.00	0.16
Sailfish	0.03	2	0.02	0.04
Manta ray	0.13	1	0.09	0.02
Other Tuna	1.84	0	1.21	0.00
Barracuda	0.02	27	0.01	0.55
Unspecified species	0.08	0	0.05	0.00

Charter vessel pelagic fisheries

A large fleet of charter vessels in Hawaii harvests pelagic species. Fish caught by charter boat patrons are generally sold by the captain and crew. HDAR began differentiating catch report data for the charter sector in 1985. Charter vessels are identified on the annual application form for a commercial marine license, and HDAR can cross-reference the numbers on the license applications submitted by charter vessels with license numbers recorded on commercial fish catch reports. Catch and effort information on charter trips for 1990–1996 is provided in Figure 2. Composition of charter pelagic species catches in Hawaii for 1996 is provided in Table 4.

In American Samoa the charter fleet consists of one or two boats that target pelagic species, but it is not possible to separate the size and composition of charter vessel catches from total landings by troll gear.

The small fleet of charter vessels in Northern Mariana Islands frequently targets pelagic species. These vessels generally retain half or more of their catches for sale in local markets.

Figure 2. Hawaii charter troll catch and CPUE, 1990–1996 (Source: HDAR)

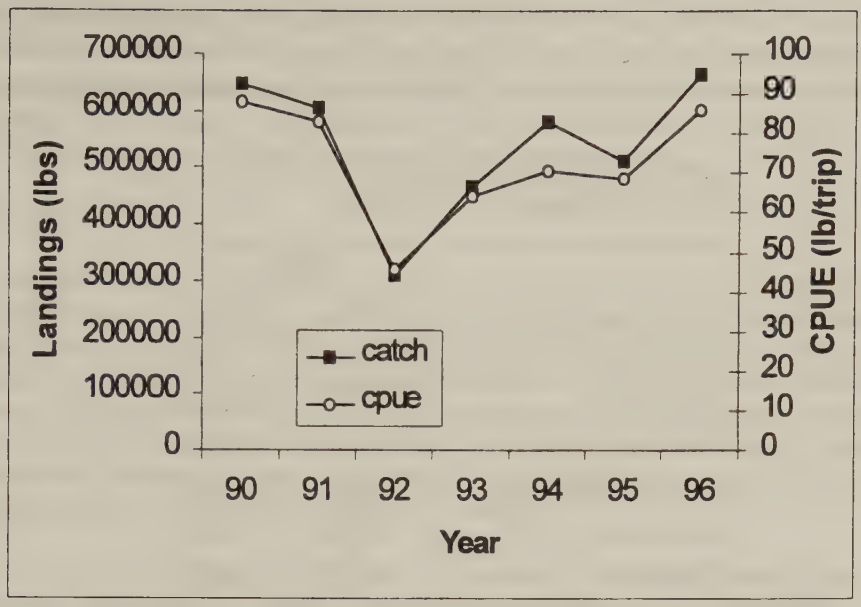


Table 4. Composition of charter pelagic species catches in Hawaii,1996 (Source: HDAR)

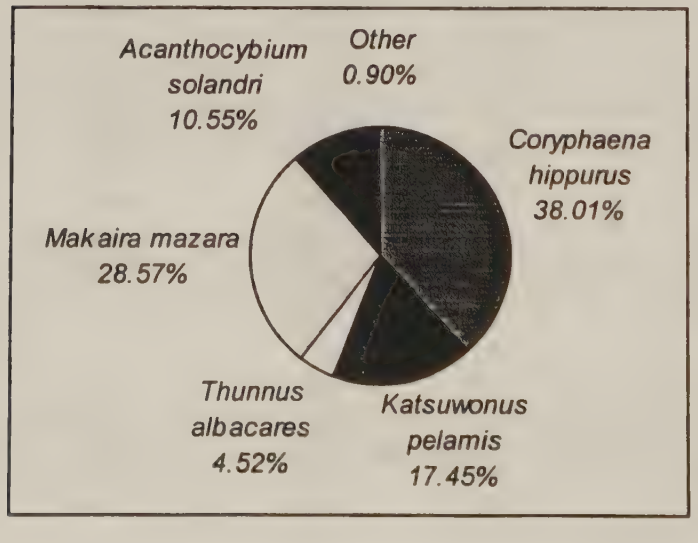
Species	Numbers	Weight (lbs)	Weight sold (lbs)	Value ($)
Mahimahi	3033	62,846	47,649	125,635
Aku	2,261	19,405	13,114	25,620
Ono	1,903	43,088	32,009	77,991
Blue marlin	1,880	390,516	304,596	211,674
Yellowfin tuna	1,770	70,113	60,130	119,272
Striped malin	745	48,130	26,966	26,451
Spearfish	381	12,174	6,611	7,649
Mano	207	12,034	6,545	6,113
Kawakawa	58	466	294	534
Ulua	57	1,329	496	644
Bigeye tuna	31	152	0	0
Kaku	21	422	92	92
Uku	19	202	70	197
Kamano	16	152	69	66
Black marlin	13	2,279	2,279	1,819
Broadbill	5	755	755	1,723
Kahala	4	78	0	0
Mako	1	93	93	88
Total	12,405	664,234	501,768	605,574

In Guam a small but significant segment of the troll fleet consists of charter vessels. Fishermen must report participation in charter fishing on their catch report form and report the number of guests taken on a charter trip. At present, the Guam Department of Aquatic and Wildlife Resources is refining the algorithms used to estimate the amount and composition of the charter component of pelagic species landings. Table 5 shows Guam charter troll catch and effort for 1996 and 1997, and Figure 3 summarizes the composition of the catch in 1996.

Table 5: Guam charter troll catch, effort and CPUE, 1996-1997 (Source: Guam DAWR)

	Year	
	1996	**1997**
Total trips	5745	4751
Total catch	205948	164696
Total hours	19420	14621
Total no. persons	35170	27683
Person-hrs	117784	83979
Gear-hrs	85138	64885
CPUE (lb/trip	35.85	34.67
CPUE (lb/hr)	10.6	11.26
CPUE (lb/gr-hr)	2.42	2.54

Figure 3. Composition of charter pelagic species catches in Guam, 1996 (percent of total number) (Source: Guam DAWR)



Appendix 8

Recent National Marine Fisheries Service research and activities related to central and western Pacific pelagic fisheries:1997-98 *(Excerpts from the Southwest Fishery Science Center Director's Report to the 49th Tuna Conference, NMFS Administrative Report LJ-98-04)*

This report describes tuna-related research activities at the Southwest Fisheries Science Center (SWFSC) conducted by the Honolulu Laboratory in Hawaii and the La Jolla Laboratory in California. It is not a comprehensive account, but rather an informal summary of activities and events.

FISHERY MONITORING

Hawaii Longline Fishery—The Honolulu Laboratory continued to monitor the Hawaii-based domestic longline fishery, documenting that 1997 was a record year in terms of pounds landed (whole weight) and ex-vessel revenue. Total longline landings were 27 million pounds (worth $58 million). The total number of fishing vessels was relatively stable at 105 vessels in 1997, compared to 103 vessels in 1996, but remains approximately 25% below the peak years of the early 1990s. The largest change has been the shift in targeting from swordfish to tuna, with only 26 vessels taking swordfish-directed trips in 1997. In addition, a number of longline vessels targeting swordfish off-loaded and operated out of ports in California for at least part of the year. However, by year's end a number of East Coast swordfish longliners had returned to Hawaii.

Other changes in fishing effort include a substantial decrease in use of light sticks per hook on swordfish trips (to 0.35 per hook in 1997 from 0.75 in 1991) and an increase in hooks per set on tuna trips (1,600 hooks per set). In addition, with the increased tuna trips, more fishing is occurring within the Exclusive Economic Zone (EEZ) of the main Hawaiian Islands (671 trips and 32.5% of all hooks set).

In terms of catch, bigeye and albacore were the leading fish retained, while blue shark continued to be caught in the largest number. In 1997, almost 60% of sharks were retained, usually for the dried fin market. There was a dramatic decline in swordfish landings in 1997 as targeted trips dipped substantially: only 7,307 swordfish were caught in 1997, compared to 38,225 in 1996. The catch rate on these trips rose in 1997, but given the small number of trips, this is probably not an indication of stock abundance. The catch of blue sharks was also down in 1997 to 79,978 fish, compared to 96,224 fish in 1996, again because of the decrease in swordfish trips. Bigeye tuna had the highest landings (79,687 fish) in 1997, with catch rates on tuna target trips at 5.63 per 1,000 hooks.

Albacore tuna continued its dramatic rise in landings since the early 1990s, with the total number of fish caught rising to 71,079 in 1997, compared to 57,329 in 1996 and only 14,051 in 1991. Catch rates on mixed target trips in 1997 were at 2.77 per 1,000 hooks and on tuna target trips at 5.10 per 1,000 hooks. Yellowfin tuna appeared to be an important "target" on mixed target trips, with a catch rate of 3.30 per 1,000 hooks.

The value of shark landings (from the dried fins) and albacore also has risen dramatically since the early 1990s. In 1997, the fisheries yielded an estimated ex-vessel revenue of $1.25 million for shark and $4.6 million for albacore, compared to $1.06 million and $3.3 million, respectively, in 1996 and $144,000 and $924,000, respectively, in 1991. Albacore landings (whole weight) have increased more than their value because of their relatively low price ($1.28 per pound, round weight) in 1996.

Incidental Catch of Blue Shark by the Hawaii Longline Fishery—There is no U.S.-directed shark fishery in the central and western Pacific. However, a great many sharks are taken incidentally in the Hawaii domestic longline fishery. The number, species, and disposition of sharks caught are reported in federal logbooks. The number of sharks caught by the fishery has ranged from about 70,000 to 155,000, and in the recent four years has been between roughly 85,000 to 115,000. Approximately 95% of the sharks caught are blue sharks, with mako, bigeye thresher, and an array of species comprising the balance. During 1991 through 1994, most of the shark catch

(ca. 55-70%) was taken during fishing operations targeting primarily swordfish. However, since 1995, the proportion of sharks caught by swordfish fishing operations has dropped significantly to 14% in 1997, while the proportion of shark caught during tuna and mixed fishing operations has increased. In the early 1990s, most sharks caught were released by fishermen (about 90-97%), and based on observer records, 80% were alive at the time of release. Since 1995, there has been a large increase in the proportion of sharks kept for processing; for example, in 1997, nearly 58% of the sharks caught were retained for processing. Essentially all of the blue sharks that are retained by fishermen are processed for fins. Varying amounts of the other shark species that are kept are processed for flesh and fins or fins.

The Hawaii longline fishery expends about 12-15 million hooks annually and catches an estimated 2,000 metric tons (t) of blue sharks. This is less than 1.5% of the total estimated annual catch of blue sharks taken by other longline fisheries in the Pacific Ocean, which annually set roughly 710 million hooks and catch an estimated 148,000 t of blue sharks.

In order to gather more information about the status of shark resources in the central-western Pacific, research is underway at the Honolulu Laboratory to estimate the catch of sharks by the Hawaii longline fishery, evaluate the performance of logbook records for assessing shark catch, gather biological data for blue shark stock assessment, and evaluate impacts of the longline fishery on Pacific blue shark populations.

American Samoa Longline Fishery Continues to Grow—The American Samoa longline fishery continued its rapid growth of the past three years. Most vessels in this fishery are small, 20- to 30-foot alia (open steel-hulled catamarans) setting 100-300 hooks hauled by hand cranks on one-day trips within 25 miles of shore. During 1997, 22 longliners were active in the American Samoa fishery, making 1,536 sets. Approximately 421,000 hooks were set. The primary catch in 1997 was albacore tuna (13,103 fish) with a catch rate of 31.2 per 1,000 hooks. Yellowfin tuna was the second largest catch (947 fish), with a catch rate of 2.25 per 1,000 hooks.

Workshop Convened on Sea Turtle and Seabird Takes in Hawaii Longline Fisheries—During April, a workshop was convened by the Honolulu Laboratory to 1) review the statistical methods used to estimate incidental takes of sea turtles and seabirds in longline fisheries, 2) identify theoretical and practical considerations for development of take estimation strategies, and 3) recommend steps to improve take estimation methods.

In the United States and other countries, incidental takes of sea turtles and seabirds have become a significant management issue in longline fisheries. Consequently, in a growing number of fisheries, programs have been established to monitor fishery interactions with turtles and seabirds and to estimate the magnitude of takes and related mortality. In some fisheries, ancillary research has been undertaken to assess impacts of the mortality on the status and recovery of affected populations and to develop effective take mitigation measures.

Take estimation involves a number of difficult statistical issues. These include the rarity and patchiness of take events for many species, low coverage (sampling rate) in the observer programs used to collect take data, and complex relationships between the frequency of take events and a range of biological, technological, and other factors. Various methods have been used to derive estimates of turtle and seabird takes in longline fisheries and assign levels of statistical reliability to them.

The workshop considered four "case studies," including the Hawaii longline fishery for swordfish and tuna. These described a range of fishery situations and the statistical methodologies currently applied to them. Drawing in part on the case study descriptions, workshop participants discussed theoretical and practical statistical issues arising in take estimation, design of take monitoring surveys, and related topics. The group developed a set of recommendations for ways to improve take estimation methods or surveys. Workshop proceedings will be compiled and published as a NOAA Technical Memorandum.

1997 Pelagic Economic Research—The Hawaii Fishing Industry and Vessel Economics Project (HIFIVE) of the JIMAR PFRP is the primary locus for economic research at the Honolulu Laboratory. Research completed in 1997 included a cost-earnings study of the small-boat commercial and recreational fishery in Hawaii and the initiation of a similar study of charter boats. A study of charterboat patrons will be initiated in 1998. Results from these studies were reported by JIMAR cooperative researcher M. Hamilton at the 1998 Lake Arrowhead Tuna Conference.

U.S. Tuna Purse Seine Fishery Annual Report—Monitoring catches in the U.S. tuna purse seine fishery in the central and western Pacific continued at the Center during the year. A report on the 1997 U.S. fishery was presented at the March 1998 meeting of the South Pacific Regional Tuna Treaty in Vava'u, Tonga.

During 1997, 33 U.S. vessels made total landings of 146,200 metric tons (t) of tuna from the central-western Pacific, down 2% from catches recorded in 1996. Landings consisted mainly of skipjack tuna (85,700 t) and yellowfin tuna (50,400 t), with lesser quantities of bigeye tuna (10,100 t). Catch rates in tons per day fished rose slightly in 1997 to 21.2 t per day fished, compared to 21.0 t per day fished in 1996. The yellowfin tuna catch rate of 8.4 t per day fished was double the rate recorded for U.S. vessels in 1996. However, the skipjack tuna catch rate of 12.8 t per day fished was well below the 1988–96 average of 18.2 t per day fished. Most fishing effort (92% of 7,400 days fished) was concentrated around Howland, Baker, Jarvis and Phoenix Islands. As in the previous year, fishing effort on drifting objects (e.g., fish aggregation devices and logs) continued to increase, and for the first time sets on tuna associated with drifting objects (59%) surpassed sets on free-swimming schools of tuna.

At the U.S. canneries in American Samoa, bigeye tuna landings were recorded as yellowfin tuna landings, and species composition samples were taken to obtain the catches by species. Species composition sampling indicated that the highest mixing of yellowfin and bigeye tunas (37%) occurred in drifting object sets on small fish (<9 kg). The average size of tropical tunas caught in 1997 was generally larger than for fish caught in 1996. Yellowfin tunas showed the largest difference in size (more than 10 cm) on average. In 1997, 49% of the trips recorded discards of tunas and 78% recorded bycatches of other species. The catches listed above include 500 t of recorded tuna discards, the majority of which was small (<1.4 kg) skipjack tuna. Sharks comprised the largest share of bycatch species, followed by rainbow runner and mahimahi.

WPYRG Meeting Held in June 1997—The seventh meeting of the Western Pacific Yellowfin Tuna Research Group (WPYRG) was held in Nadi, Fiji, June 18-20, 1997. G. Sakagawa, chief of the La Jolla Laboratory's Pelagic Fisheries Resources Division (PFRD), was chairperson of the group, which is composed of scientists, fishery representatives, and spokespersons from 16 countries. The meeting was attended by 38 participants, the largest number since the group was organized in 1990. The group reviewed 23 technical papers on western Pacific yellowfin tuna fishery statistics, fishery developments, research results, and research progress. One result of the meeting was a determination that the overall declining catch, catch rate, and sizes of yellowfin tuna observed over the past few years and in several surface fisheries suggest that the stock is being exploited beyond the safe level for long-term maximum sustainable yield. The group, however, also noted that this might not be a stock abundance effect but rather a stock availability effect caused by the unfolding regime shift in the Pacific-wide oceanic environment. Analysis of catch information from the 1997 and 1998 fishing seasons, which were anticipated to occur with El Niño conditions that historically have made yellowfin tuna more available to the surface fisheries of the central-western Pacific, may help to address these questions.

The group also discussed the increasingly important issue of overfishing of bigeye tuna. Catches of bigeye have increased significantly and may be related to the expanding use of floating fish aggregating devices by purse seiners. The impact of higher catches on the bigeye stock is not clear because little is known of the biology and stock structure of this species.

1996 Albacore Fishery Data Summarized—Statistics on the U.S. North and South Pacific albacore fisheries were analyzed during the year by SWFSC staff and summarized in a report (SWFSC Admin. Rep. LJ-97-

07) distributed last August. The total catch for these fisheries in 1996 was 17,800 metric tons (t) with an estimated value of $39 million. Following is a summary of the report:

North Pacific Fisheries–U.S. troll vessels completed a total of 1,200 trips during the 1996 North Pacific albacore fishery, which began in May and ended in early November. Catches of North Pacific albacore in 1996 continued to rebound from the low catches recorded in the mid-1980s and the early 1990s. Albacore landings for the 1996 fishery increased to 15,600 t from 8,200 t in 1995. Catch rates increased to 91 fish per day in 1996, compared to 47 fish per day in 1995. The average size of albacore decreased to 13 lb or 5.9 kg in 1996, compared to 15 lb or 6.7 kg in 1995.

South Pacific Albacore Fisheries–The 1995–96 South Pacific fishing season began in December 1995 and lasted through March 1996. A total of 44 trips were completed by U.S. troll vessels participating in the fishery. U.S. catches increased slightly to 2,200 t in the 1995–96 fishing season, compared to 2,000 t in 1994–95. Catch rates decreased substantially to 71 fish per day in 1995–96 season, compared to 150 fish per day in the previous season. The average size of albacore caught decreased slightly to 15 lb or 6.7 kg in 1995–96 from 16 lb or 7.0 kg in 1994–95.

15th North Pacific Albacore Workshop Held in December—Center scientists presented eight papers at the 15th North Pacific Albacore Workshop in Nanaimo, British Columbia, December 3-5, 1997. At the workshop, 17 participants from Canada, Japan, Taiwan, and the United States reviewed working documents on North Pacific albacore and achieved several workshop objectives, including selection of biological reference points to be used for monitoring overfishing of the stock and comparing independent stock assessments of stock conditions. Stock assessment models used by the workshop indicate that the condition of the albacore stock is improving to a biomass level near maximum sustainable yield, which was estimated to be in the 80,000 to 104,000 metric ton (t) range. If future catches do not increase greatly above the current level (70,000 t) and stock parameters remain at current levels, the biomass should continue to increase or remain stable.

Results of 1996 and 1997 Billfish Angler Survey Reported—Two components of the billfish investigations are the International Billfish Angling Survey, which tracks changes in recreational angling catch and effort, and the Cooperative Billfish Tagging Program, which provides information on the distribution, migratory patterns, and growth rates of Pacific and Indian Ocean billfishes. The results are published annually in the Billfish Newsletter. Te Center has collected angler catch and effort data through the Billfish Angler Survey annually since 1969. These data are collected from individual anglers, sportfishing clubs, and cooperating international and national agencies. Trends in angler catch rates at major billfishing areas throughout the Pacific and Indian Oceans aid in understanding the impact of commercial fisheries on billfish resources. Long-term trends are used to identify emerging issues resulting from fishery, environmental, economic, and other causes. Results from the 1996 and 1997 fishing seasons are reported here.

Angers responding to the International Billfish Angler Surveys reported catching 3,712 billfish during 6,642 fishing days in 1996 and 4,698 billfish during 10,973 fishing days in 1997. The overall success rate was 0.56 in 1996 and 0.43 billfish per angler-day in 1997. The current average catch per unit of effort of 0.48 for 1996 and 1997 is consistent with the preceding five-year average (1991 to 1995) of 0.46 and nearly the same as the pre-preceding five-year period (1985 to 1989) of 0.54. The highest reported catch rate was from 1969 to 1971 (WHAT WAS THE RATE?) and the lowest (0.38) occurred in the mid-1970s.

The principal value of these data is in long-term trend analysis compared with other events such as regional commercial fisheries, weather patterns, and local economic changes. Many fishing nations throughout the Pacific and Indian Oceans are expanding their pelagic fisheries beyond traditional waters. The trend analysis from this survey assists in monitoring the impact of this expansion and highlights the importance of recreational fishing for billfish and the economic contribution to local communities.

TAGGING AND TRACKING

1997 Cooperative Marine Game Fish Tagging Program Results—The Center's angler-based Billfish Tagging Program began in 1963. The program encourages the participation and cooperation of recreational anglers, commercial fishers, and affiliated research agencies. The specific goal of the program is to determine migration, distribution, and growth patterns of billfish utilizing tag recapture data.

Figures from Billfish Tagging Report cards received by Center in 1997 indicate a total of 849 billfish were tagged and released by 554 anglers and 219 fishing captains. This is 29% fewer tag releases than reported in 1996. Fewer billfish of all species were tagged last year. Six striped marlin, six blue marlin, one sailfish, two swordfish, and one shortfin mako shark were recaptured in 1997. Long-term recapture rates are: striped marlin, 1.63%; blue marlin, 0.86%; black marlin, 2.07%; sailfish, 0.38%; and swordfish, 2.36%. Twenty-eight percent of recaptures occurred within the first month after release and 77% within the first year. Only 1% of recaptured billfish were at liberty three years or longer.

Recapture data indicate billfish are both robust and resilient to the stress of post-tagging trauma, travel long distances, and have established migratory patterns. Billfish routinely make trans-Pacific and equatorial crossings which expose them to numerous international commercial and recreational fisheries. While most of the fishery-related impacts occur on the high seas, significant interactions also occur within the EEZs of the various countries throughout the Pacific region. Clearly, international monitoring of the Pacific billfish resource is needed to understand the extent of billfish/fishery interactions.

In other tagging program activities during the year, the Center and The Billfish Foundation began a joint analysis of their sets of tagging data for the Pacific Ocean. The Center also furnished tagging supplies to tournament anglers and reported results of tagging in the Pacific area.

Satellite Tracking Used to Study Post-hooking Survival of Sea Turtles—At the Honolulu Laboratory, researchers have begun using satellite telemetry to measure the survivorship of sea turtles incidentally hooked and released alive in the Hawaii-based longline fishery. In a feasibility study conducted during the year, commercially available satellite transmitters were attached to the carapaces of hard-shelled turtles by trained NMFS observers aboard commercial fishing vessels, using techniques perfected by the Honolulu Laboratory. Satellite data on the locations and movements of the turtles were relayed daily to the Honolulu Laboratory for processing, analysis, and mapping.

By April, the researchers had successfully tracked post-release movements of nine pelagic loggerhead and four pelagic olive ridley turtles across the North Pacific for up to six months over distances from 160 to 6,950 km. In addition, three other loggerheads and a green turtle were recently equipped with transmitters and released after being hooked. The hooking status of the 13 tracked turtles ranged from "lightly hooked" (hook easily removed from the beak or flipper) to "deeply ingested" (hook deep in the esophagus and impossible to safely remove). Six turtles (two ridleys, four loggerheads) were lightly hooked and seven (two ridleys, five loggerheads) were deeply ingested. Preliminary results demonstrate that at least some of the turtles with deeply ingested hooks were capable of swimming considerable distances against prevailing currents, presumably in a normal fashion.

The next phase of this research project will incorporate the use of several satellite-linked dive recording transmitters to collect information on turtle diving patterns and surface intervals. In addition, a number of transmitters will be deployed with about one-third more battery reserve to provide better insight into transmitter life.

This project has benefited substantially from a teamwork approach in collaboration with other researchers at the Honolulu Laboratory. Satellite tracking of all turtles is being analyzed in relation to geostrophic current and other oceanographic environmental data supplied by satellites. Results will ultimately provide new and important information that will benefit longline fisheries and increase knowledge of the pelagic life histories of sea turtles.

Archival Tagging of Bigeye Tuna and Swordfish—To understand harvest impacts and interactions among fisheries for tuna and billfish across the Pacific, information is needed on migration patterns and on how environmental factors influence distribution and catchability. The recent development of archival tags provides a new tool for studying fish movement and habitat over long periods. Decades of conventional tagging and ultrasonic tracking research have not provided the important insights into long-term cyclical movement patterns produced by archival tags. The new tags are being used in an archival tagging project on bigeye tuna and swordfish that the Honolulu Laboratory is conducting in collaboration with the Joint Institute for Marine and Atmospheric Research's Pelagic Fisheries Research Program (JIMAR PFRP, University of Hawaii) and the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia.

Originally, the archival tagging project was intended to deploy new pop-up, satellite-transmitting archival tags (PSTATs) on swordfish. For species such as the swordfish, marlins, and perhaps sharks, in which recapture rates are likely to be very low, the high cost of using conventional archival tags is a major deterrent. The PSTAT tags are designed to be released from fish at predetermined times, pop up to the surface of the ocean, and transmit a record of movements and habitat use to researchers via satellite. Some early versions of such tags which do not yet archive geopositions have been deployed by other researchers. Pop-up tags which will archive geoposition have been promised by several commercial electronics manufacturers but are not yet in production. Rapid external attachment of PSTATs will be achieved by harpooning an intramuscular tag anchor into the fish which then trails the tag on a tether. Early on, the project designed tag anchors which were successfully tested using dummy PSTATs on southern bluefin tuna in Australia.

In 1997, the project contracted for the design of a hydrodynamic pop-up tag container, incorporating a rapid "failsafe" release mechanism to prevent its crushing if the fish descends below specified depths. The completed design has a round ogival nose, ducted tail fins, and a trailing antenna. A pyrotechnic detachment mechanism forces the nose cone, to which the tether is attached, forward out of the tag body, leaving the PSTAT positively buoyant and simultaneously deploying a pendant counterweight to improve vertical antenna stability. Improved geolocation software for use on archival tag and PSTAT time-depth recorders is under development by CSIRO, which will incorporate these improvements in PSTATs now being built to their specifications for delivery in late 1998.

Meanwhile, because of PSTAT production delays, 80 conventional archival tags were purchased from two vendors in 1997 for investigations involving bigeye tuna, a species with much higher recapture rates. Testing of tags from both sources revealed serious malfunctions, which were corrected by the vendors. Some tags are again undergoing tests, but in April 1998 the project began deploying fully tested tags on a longline research cruise, where 13 tags were deployed on bigeye tuna off Kona, Hawaii. In July an archival tag was recaptured by a handline fishing vessel off Hookena, Hawaii and contained a complete record of the behavior of the fish over three months. Analysis of this data is now progressing, indicating that the fish remained near the main Hawaiian Islands, swam at depths within 100m of the surface at night and at depths from 200-500m during the day. Nighttime depths were closer to the surface (~40 m) during the new moon and deeper (~ 80 m) during the full moon. More tags will be deployed in October 1998 and January 1999.

Longline Research on NOAA Ship *Townsend Cromwell*—In addition to the archival tag deployments in April 1998, a longline research cruise aboard R/V *Townsend Cromwell* was conducted in late August and September 1997 in the equatorial current region south of the Hawaiian Islands. This area was found to be productive for swordfish tagging at a time of year when fishing areas north of the Hawaii-based fishery are unproductive or beset by bad weather. The main objective of this cruise, and swordfish longline cruises since 1996, was to develop methods to increase live swordfish capture rates and viability for tag and release. Longline-caught swordfish are frequently dead or moribund by the time the line is hauled. Swordfish often swallow the bait and become hooked in the gut, and if they are not retrieved before daylight they may die fighting to dive. Different hook types and shorter fishing intervals are being tested in an effort to reduce capture mortality.

A host of other objectives were also served by the research cruises, including the collection of oceanographic data on the fishing grounds, and the collection of samples used in studies of swordfish age, growth, sex, reproduction, parasitology, and physiology. Catches of other species, such as sharks and sea turtles, are also studied, and viable animals are tagged and released. The 1997 cruise was a collaboration between the Honolulu Laboratory and Inter-American Tropical Tuna Commission (IATTC) researcher M. Hinton, who used the opportunity to collect morphometric and reproductive activity data from istiophorid billfishes and genetic data from bigeye tuna for ongoing and cooperative investigations of the IATTC.

Townsend Cromwell provides an excellent platform for longline research. Research fishing gear is more cumbersome than commercial gear, but research gear provides information that complements logbook and observer data relative to factors affecting catch rates for the various pelagic species. For example, depth of fishing and time of day are major influences on catch per unit effort (CPUE). Logbook data include a target fishing depth and hook per float information related to fishing depth but lack capture time data. Observers collect more details regarding commercial gear configuration and are often able to note hook positions and haul times for individual fish. On *Townsend Cromwell*, the longline gear is fitted with both time-depth recorders to measure true gear depth and hook timers that record when fish actually bite. When fish are retrieved alive the timers measure hooked longevity, which indicates differences in relative viability among capture modes.

The cruise encountered concentrations of swordfish and silky shark in the north edge of the north equatorial counter current. Generally, 450-500 hooks were used on each set of the longline. The line was set each evening using frozen squid for bait and a light stick attached to each ganglion. Retrieval of the longline was initiated each morning at about 0400 h and was completed by about 1000 h. Thirty-one swordfish were obtained for sampling during 17 days of fishing. In addition, tissue or data (or both) were collected from 22 bigeye tuna, seven blue marlin, and four striped marlin. Swordfish CPUE averaged 5.0 per 1,000 hooks, and fish weighed between 31 and 547 lb (mean = 150 lb, round weight). The locations and relative speeds of the various equatorial currents were clearly indicated by an analysis conducted at the Honolulu Laboratory based on satellite altimetry data received from the ship every 10 days. Current locations were confirmed by shipboard acoustic and electronic instruments and by longline drift. Successful sets ranged from about 40 m to 80 m deep. Four hook types were compared to see if some types had a lower incidence of gut hooking. Preliminary results suggest that viable live captures were more numerous but not because of the novel hook types or shorter fishing intervals: more fish were jaw hooked and viable for release, and more gut-hooked fish were still alive. It is hypothesized that feeding behavior was different because the swordfish mouthed the bait more before swallowing it. Also, the oxycline was much shallower than in the northern fishing grounds, dropping below 1 mg/l at 100 m. Perhaps with so little oxygen at depth, swordfish did not fight so hard to dive. In any case, the area looks promising for future swordfish tagging efforts.

BIOLOGY AND OCEANOGRAPHY

Swordfish Size at Sexual Maturity and Sex Composition of Catches Estimated—Sex-specific body size at sexual maturity of swordfish caught by the Hawaii-based longline fishery was estimated in a paper (DeMartini et al., submitted to Fish. Bull.), which also described temporal and spatial patterns in the size and sex composition of catches. This study is significant because the dynamic nature of catch and effort statistics for Pacific swordfish requires an age-structured approach to stock assessment. Age at sexual maturity, derived from size-at-age and size-at-maturity estimates, constitutes a fundamental part of any age-structured model. Temporal and spatial patterns in size and sex composition data can help stratify catch and effort data and reduce the overall variance of catch statistics.

Body size at 50% sexual maturity was estimated separately for male and female swordfish. More than 1,300 gonad tissue specimens, collected at sea by NMFS Southwest Region observers over a 40-month period (March 1994–June 1997), were evaluated using histological criteria to determine state of maturation. Estimated size at maturity was 143 $\pm$ 3 cm eye-to-fork length (EFL) for more than 800 females, and 102 cm $\pm$ 2 EFL for about 500 males. Females and males predominated at body lengths > 150 cm and < 140 cm EFL, respectively. Sex ratios

(females/total) were consistently > 0.9 at lengths > 215 cm EFL, indistinguishable from 0.5 at lengths < 100 cm, and a positive function of length between 100 and 215 cm EFL.

The size and sex compositions of swordfish catches were both temporally and spatially dynamic. More male swordfish were caught south of 27°N latitude, whereas females predominated north of the same latitude. The largest fish (both sexes, but mostly female) were caught above 35°N latitude during late summer-early winter. Reproductively active fish of both sexes dominated catches near the Hawaiian Archipelago during early spring-early summer. Small-bodied fish of both sexes prevailed below 22°N latitude.

Estimates of swordfish body size at sexual maturity provide a key element for the age-structured stock assessment models that are under development. The described patterns of size and sex composition should help identify important temporal and spatial strata for reducing the variance of swordfish catch and effort statistics.

Swordfish Size-at-Age Studies Continued—Age and growth studies of swordfish continued with complementary analyses using otoliths and anal fin rays. Counts of presumed "daily" microincrements were completed for a cumulative total of 27 young-of-year (YOY) and yearling swordfish ranging from 19-135 cm EFL and an estimated 31 to 616 days old. Length at age-365 days was estimated as 106 cm EFL (95% CI = 84-129 cm EFL). Preliminary analyses further suggest that the age of young swordfish can be predicted from length of counting path (otolith rostrum), implying that rostrum length might provide a cost-effective proxy for age based on microincrement counts.

Preparation and analyses of anal fin rays continued for swordfish spanning the entire range of exploited sizes from about 70 to > 230 cm EFL. Preliminary ageing and fin ray measurements were completed for a cumulative total of more than 1,000 fish (550 females and 450 males). An ongoing focus has been to match size at age-1 year from fin ray cross-sections with size at age 365 days from otolith microincrement counts. Limited (n = 3) recaptures of tagged yearling fish at liberty for one, two, and four years indicate that a preliminary characterization of length-at-age is reasonable.

A von Bertalanffy growth function utilizing comprehensive data for YOY through large adult fish would provide more accurate estimates of instantaneous growth rates. Estimates of growth as well as age-at-maturity distributions are essential elements of pending age-specific stock assessments for swordfish in the Pacific.

Satellite Altimetry Used in Swordfish Research—In February, at the Ocean Sciences Meeting held in San Diego, California, Honolulu Laboratory researchers presented two posters on new applications of satellite altimetry to swordfish research. One presentation, "Diagnosis of the variability of swordfish catches north of Hawaii" by G. Mitchum and J. Polovina, used TOPEX/Poseidon (T/P) satellite altimetry data to construct an index of the strength of the subtropical front, showing that this index was highly correlated with swordfish CPUE in the Hawaii-based longline fishery. Thus, variation in fishery CPUE to date largely reflects changes in the strength of the subtropical front. Other satellite information currently is being used to examine the spatial and temporal dynamics of chlorophyll (a measurement of productivity) at the subtropical front and to ultimately describe swordfish forage habitat.

The second presentation, "Use of near real-time TOPEX/Poseidon altimetry to guide fisheries oceanography field studies in the central North Pacific" by M. Seki, D. Kobayashi, J. Polovina, and G. Mitchum, described results from 1997 shipboard oceanographic surveys of the North Pacific subtropical front region. This research, which continues with another survey scheduled during April-May 1998, uses the satellite altimeter data to elucidate the position and mesoscale variability of the subtropical front, which corresponds closely with areas of greatest swordfish fishing activity and highest catch rates, particularly early in the fishing season (for example, March). Hydrographic transect lines through the front and selected mesoscale features identified from altimetry are subsequently conducted to collect information on the distribution and interplay of physical, chemical, and biological properties through the water column.

Pelagic Ecosystem Modeling—J. Kitchell (University of Wisconsin) visited the Honolulu Laboratory during January 1998 to work with C. Boggs on a model of the central North Pacific fishery ecosystem. Beginning in September 1998, this work will be funded for four years by a $540,000 National Science Foundation grant to Dr. Kitchell. Much of this work will be done in collaboration with the Honolulu Laboratory. Building upon preparatory work conducted throughout 1997, Boggs and Kitchell used the Ecopath modeling approach originally developed by J. Polovina and new Ecosim software developed by C. Walters to conduct various simulations. One example illustrated the effects of reducing fishing mortality to circa 1950 levels (before distant-water longline fisheries spread across the Pacific). When fishing mortality alone was considered, the abundance of most exploited species was much higher circa 1950. For the slowest growing (k-select) groups such as sharks, billfishes, and bigeye tuna, the abundances circa 1950 were even greater when food web interactions were included. In contrast, the model predicted that the abundance of some very fast growing (*r*-select) exploited groups such as mahimahi and small tuna, as well as many forage species, was lower circa 1950 than now.

Another simulation examined the effect of a 50% pulse in primary productivity. Fast growing, short-lived animals such as mahimahi, squids, flying fish, small billfishes, and small tuna respond quickly to the increased productivity, increasing in biomass by 50% within a year after the productivity pulse. For these animals the biomass increase is short lived (1-4 years), whereas large tunas and juvenile sharks showed more moderate biomass increases (25-15%) that were sustained for longer periods. Adult billfishes and sharks showed very little response to the pulse.

Habitat and Physiology of Bigeye Tuna Studied—The physiological capabilities of bigeye tuna which determine their habitat and capture depth are the subject of a University of Hawaii JIMAR PFRP project led by R. Brill in collaboration with the Honolulu Laboratory. Studies of habitat depth have important influences on catchability and have played an important role in improving stock assessment models. Data from ultrasonic telemetry studies conducted near the main Hawaiian Islands clearly show that bigeye tuna have significantly greater vertical mobility than yellowfin tuna. In other words, bigeye tuna appear more tolerant than yellowfin of the rapid ambient temperature change experienced during descents through the thermocline. Both longline capture-depth data and whole animal physiology studies strongly suggest that bigeye tuna are able to exploit more of the water column because they are also more tolerant of low ambient oxygen than are yellowfin or skipjack tunas.

Fishes that tolerate low ambient oxygen often have blood with a high oxygen affinity, but usually they are also sluggish, low-energy-demand species. This is because blood with an enhanced oxygen affinity does not readily release oxygen (in the muscles) in a manner necessary to support high rates of aerobic metabolism. It thus seems incongruous that bigeye tuna (a high-energy-demand species) could also be tolerant of low ambient oxygen. This study was undertaken to better understand the physiological basis for bigeye tuna's apparent enhanced tolerance. The ultimate goal is to provide data from which the depth distribution of bigeye tuna (and other tuna species) can be modeled or predicted based on temperature and oxygen stratigraphy. These types of models/predictions are critical for correcting abundance estimates based on CPUE data (i.e., for differentiating changes in abundance from changes in gear vulnerability).

Using standard in vitro techniques, this study found bigeye tuna blood to have an unusually high oxygen affinity. When equilibrated with 0.5% CO_2, the P_{50} (the partial pressure of oxygen needed to achieve a blood oxygen content that is 50% of the maxim theoretical oxygen content based on measured hemoglobin concentration) was only 12-15 mm Hg in bigeye tuna blood, compared with 21-23 mm Hg in skipjack and yellowfin tuna blood. These data support the conclusion that bigeye tuna are better adapted for taking up oxygen from the water under conditions of low ambient oxygen than are yellowfin or skipjack tunas. This study also found the oxygen affinity of bigeye tuna blood to be essentially temperature-independent when subjected to a 10°C open-system temperature change, as is the blood of all other tuna species studied to date. (Subjecting blood to open-system temperature changes in vitro mimics temperature changes occurring in vivo as blood passes through the gills of tunas moving up and down through the thermocline). Surprisingly, however, it was also found that bigeye tuna blood has an enhanced temperature sensitivity when subjected to a 10°C closed-system temperature change. (Closed system

temperature changes in vitro mimic temperature changes occurring when blood passes through tunas' vascular countercurrent heat exchangers). To use the physiologist's shorthand, unlike the blood of other tuna species studied to date, bigeye tuna blood has a significantly enhanced Bohr effect (i.e., $\Delta \log P_{50}/\Delta pH$) when subjected to the increases in PCO_2 and decreases in plasma pH that inevitably accompany closed-system temperature shifts.

Taken together, these data show how a high-energy-demand species like bigeye tuna can also be tolerant of low ambient oxygen. In the gills, bigeye tuna blood can readily take up oxygen even under low ambient oxygen conditions because of its high oxygen affinity. When the blood reaches the warm muscles, however, the elevated Bohr effect and resultant large increase in P_{50} ensure adequate rates of oxygen off-loading in the tissues of this teleost.

Appendix 9

Value of pelagic fisheries

Domestic Pelagic Fisheries

The management of pelagic fisheries is of particular importance to the WPRFMC, as the harvest of highly migratory species is the major fishing industry in the Pacific islands. The central and western Pacific region contains immense pelagic fishery resources and provides more than 40 per cent of the world tuna catch. The annual landings of various tuna species harvested from this region total over one million metric tonnes, with a dockside value of $1.5 billion[1].

When the WPRFMC was created in 1977 foreign fleets were fishing heavily for tuna as close as twelve miles to American-flag Pacific islands. The Council's initial priority was to restrict foreign fishing and allow domestic fishermen more opportunities to catch fish. Hawaii, being the most industrialized and populated island area, was in the best position to support an expansion of the domestic commercial fishery. The number of Hawaii-based longliners skyrocketed in the late 1980's. Landings by longline vessels increased from 1,900 to 11,500 metric tonnes between 1987 and 1993. The inflation-adjusted ex-vessel value of the catch more than tripled during this period to $56 million. Swordfish catches accounted for most of this revenue and represented about 60% of the total US domestic landings for this species. Today, swordfish continues to be an important resource in Hawaii's pelagic fishery, but the longline fleet is increasingly targeting tuna species, and the harvest of albacore, bigeye and yellowfin reached a record high of 4,000 metric tonnes in 1995.

The expansion of the longline fishery in Hawaii has been accompanied by a general trend away from "bulk fisheries" for pelagics (e.g., fish cake and canned tuna) and development of "quality," high price products (e.g., sashimi tuna and swordfish) that have enhanced the market value of Hawaii's pelagic fisheries[2] (Boehlert, 1993). Local and export markets for Hawaii's seafood products have expanded enormously in recent years, and fresh fish from Hawaii's waters now appears on restaurant menus throughout the US, from Honolulu to Des Moines to Boston[3].

Hawaii's smaller-scale troll and handline fishery has also benefitted in recent years from expanding local and export markets for high quality seafood products. Annual revenues within this fishery average around $9 million. Related to the troll fishery is the charter boat industry that targets billfish, tuna and other pelagic species mainly for a tourism-based clientele. It is estimated that charter boat patrons in Hawaii spend $61 million (adjusted to 1995 dollars) a year on charter fishing as a vacation or leisure activity[4]. Another indication of the economic importance of the charter boat industry is that a recent charter booking agency recently offered a reward of $1 million to the first customer who lands a blue marlin over 1,656 pounds, the current record for the port of Kona.

Distant-Water Pelagic Fisheries

Other island areas in the Council's jurisdiction have not experienced the same increase in domestic industrial scale fisheries that recently occurred in Hawaii. Although the size of the local fishing fleets of

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1 Lawson, T. [ed.] 1995. SPC Tuna Fishery Yearbook, 1994. South Pacific Commission, Noumea, New Caledonia, 77 pp.

2 Boehlert, G. W., 1993. Fisheries and marine resources of Hawaii and the U.S.-associated Pacific Islands: An introduction. Mar. Fish. Rev. 55(2):3-6.

3 Pooley, S.G., 1993. Hawaii's marine fisheries: Some history, long-term trends, and recent developments. Mar. Fish. Rev. 55(2):7-19.

4 Samples, K. And D. Schug, 1985. Charter fishing patrons in Hawaii: a study of their demographics, motivations, expenditures and fishing values. US Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Southwest Fish Cent., Honolulu Lab., Southwest Fish. Cent. Admin. Rep. H-85-8C, 95 pp.

American Samoa, Guam and the CNMI have expanded in recent years, the fleets continue to consist of small boats operated by mostly part-time fishermen. However, these islands have discovered alternative ways to take economic advantage of expanding Pacific pelagic fisheries. Tuna processing, transshipment and home-porting industries have developed in these islands because they possess a comparative economic advantage over other locations in the region. These advantages include proximity to fishing grounds, shipping routes and markets; the cost and availability of fuel and other goods and services that support tuna fishing operations; tariff-free market access to the US; and significant tax incentives.

For many years American Samoa's capital of Pago Pago has been the site of a major tuna canning industry and one of the leading ports in the US in terms of the dollar value of fish landings. In 1995, Pago Pago received over 170,000 metric tonnes of fish worth approximately $200 million (Table 1).

Table 1. Ex-vessel value of commercial fishery landings by domestic and foreign vessels at major US ports in 1995

Port	1995 Value of Landings -Million Dollars-	
	1996	1997
Pago Pago, American Samoa	211.8	192.7
Dutch Harbor-Unalaska, Alaska	118.7	122.6
New Bedford, Massachusetts	100.5	103.2
Agana, Guam	94,2	NA
Kodiak, Alaska	82.3	88.6
Key West, Florida	62.8	54.9
Brownsville-Port Isabel, Texas	60.0	46.1
Honolulu, Hawaii[5]	50.1	53.7
Port Judith, Rhode Island	46.0	47.6
Empire-Venice, Lousiana	45.4	57.8

Sources: US National Marine Fisheries Service (1996) and Western Pacific Regional Fishery Management Council.

Since the tuna processing industry began in American Samoa four decades ago, it has been the largest private sector employer in the Territory and leading exporter. The current fleet supplying fish to the canneries are island-based US purse seiners that fish primarily in the central and western Pacific for skipjack and yellowfin tuna, US albacore trollers operating in the north and south Pacific and foreign longline vessels that fish for large albacore, yellowfin and bigeye tuna. In addition, tuna are delivered from transshipments centers to American Samoa by freezer vessels.

During the past decade Guam and the Northern Mariana Islands have been two of the largest tuna transshipment centers in the Pacific. The fish transshipped in these islands in 1995 was valued at more than $117 million. The frozen fish is delivered by US and foreign purse seiners and foreign longliners. Large amounts of fresh tuna are also air-freighted daily from Guam and Saipan to Japanese markets.

A particularly lucrative activity related to the tuna canning and transshipment industry is the resupplying of fishing boats which deliver the fish. Pago Pago and Apra harbor in Guam are home ports to several hundred longline and purse seine vessels. Expenditures by these fleets on fuel, provisions and repairs make an important contribution to the economies of these islands. Annual local fleet expenditures in 1994 have been estimated to be

[5] Includes $3-4 million from bottomfish and lobster landings

as high as $122 million in American Samoa and $92 million in Guam[6]. This home-porting industry has both created primary jobs and enhanced investment opportunities for local entrepreneurs.

Subsistence and Recreational Fisheries

While it is important to recognize and document the significant role marine fisheries play in contemporary Pacific island economies, it is equally important to keep in mind that the value of these fisheries extends beyond the creation of employment and the generation of exports and income. Fishing activities have been interwoven into the daily lives of the people of the Pacific islands for hundreds if not thousands of years. Over time local communities developed a close, emotional as well as utilitarian association with the marine environment. It shaped their social organization, cultural values and religion.

While most island residents today no longer depend on their catches for food, seafood continues to be an integral part of the local diet. In Hawaii, for example, the per capita consumption of seafood is almost twice the national US average and is comparable to that of other Pacific islands. There has been no attempt to formally assess the subsistence fishing contribution to island economies, but the value to consumers is known to be substantial. In many rural island communities subsistence fishing is an important supplement to cash income.

In addition, despite increasing commercialization of the catch, fishing continues to contribute to the cultural integrity and social cohesion of Pacific island communities. In American Samoa, for instance, skipjack tuna, known locally as *atu*, is an especially important species both nutritionally and culturally. The methods and equipment for catching skipjack have changed, but the fish brought to shore continue to be distributed within Samoan villages according to age-old ceremonial traditions. One can find similar traditions still practiced in Hawaii, the Northern Mariana Islands and Guam. These sociocultural attributes of fishing are at least as important as the contributions made to the nutritional or economic well-being of island residents.

The fish resources under Council jurisdiction also support an important private boat recreational fishery that targets both pelagic and bottom-dwelling species. The US Fish and Wildlife Service estimated that $81.2 million (adjusted to 1995 dollars) in fishing trip-related expenditures occurred in Hawaii[7]. Of course, fishermen value fishing over and above what they spend on it. A study conducted some years ago that asked fishermen what their sport fishing experience was actually worth to them in dollar terms estimated the value of fishing trips to Hawaii recreational fishermen to be $347 million (adjusted to 1995 dollars) (Meyer Resources, Inc., 1987)[8].

One component of recreational fishing that has gained in popularity is tournament fishing. Most notable is the Hawaiian International Billfish Tournament conducted annually on the "Big Island" of Hawaii. Since its inception in 1958, this tournament has consistently attracted the most serious big game anglers in the world. In 1995, 72 boats with fishermen from 15 countries participated. Tournament fishing for pelagic species is also becoming increasingly important in American Samoa and Guam and accounts for a significant portion of domestic landings.

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6 Hamnett, M. And W. S. Pintz, 1996. The contribution of tuna fishing and transshipment to the economies of American Samoa, the Commonwealth of the Northern Mariana Islands and Guam. JIMAR Contribution (6-303), Joint Institute for Marine and Atmospheric Research, Honolulu, 38 pp.

7 US Fish and Wildlife Service, 1993. 1991 national survey of fishing, hunting and wildlife associated recreation. US Government Printing Office, Washington, D.C., 124 pp.

8 Meyer Resources, Inc., 1987. A report on resident fishing in the Hawaiian Islands. US Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Southwest Fish Cent., Honolulu Lab., Southwest Fish. Cent. Admin. Rep. H-87-8C,

Appendix 10

GLOSSARY – PELAGICS

TERM	DEFINITION
Alia	Samoan fishing catamaran, about 30 feet long, constructed of aluminum or wood with fiberglass. Used for various fisheries including trolling, longline, and bottomfishing
AP	Advisory Panel. Appointed industry/government/educational representatives functioning in an advisory capacity to the Council.
AS	American Samoa. Includes the islands of Tutuila, Manua, Rose and Swains Atolls.
ASDPW	Department of Public Works, American Samoa. Also, DPW.
Bycatch	Fish caught in a fishery but discarded or released, except in a recreational fisheries catch and release program.
Commercial	Commercial fishing, where the catch is intended to be sold, bartered, or traded.
CNMI	Commonwealth of the Northern Mariana Islands. Also, Northern Mariana Islands, Northern Marianas, and NMI. Includes the islands of Saipan, Tinian, Rota, and many others in the Marianas Archipelago.
CPUE	Catch-Per-Unit-Effort. A standard fisheries index usually expressed as numbers of fish caught per unit of gear per unit of time, eg., number of fish per hook per line-hour or number of fish per 1,000 hooks. The term catch rate is sometimes used when data are insufficiently detailed to calculate an accurate CPUE.
DAWR	Division of Aquatic & Wildlife Resources, Territory of Guam.
DBEDT	Department of Business, Economic Development & Tourism, State of Hawaii.
DFW	Division of Fish & Wildlife, Northern Mariana Islands.
DLNR	Department of Land & Natural Resources, State of Hawaii. Parent agency for Division of Aquatic Resources (HDAR).
DMWR	Department of Marine & Wildlife Resources, American Samoa. Also, MWR.
EEZ	Exclusive Economic Zone, refers to the sovereign waters of a nation, recognized internationally under the United Nations Convention on the Law of the Sea as extending out 200 nautical miles from shore. Within the U.S., the EEZ typically is between three and 200 nautical miles from shore.
ESA	Endangered Species Act. An Act of Congress passed in 1966 that establishes a federal program to protect species of animals whose survival is threatened by habitat destruction, overutilization, disease etc.
FAD	Fish Aggregating Device; a raft or pontoon, usually tethered, and under which, pelagic fish will concentrate.
FDCC	Fishery Data Coordinating Committee, WPRFMC.
FFA	Forum Fisheries Agency. An agency of the South Pacific Forum, which comprises the independent island states of the South Pacific, Australia and New Zealand. The FFA formed to negotiated access agreements between FFA member countries and distant water fishing nations such as Japan and the USA.
FMP	Fishery Management Plan.
Guam	A U.S. territory in the Marianas Archipelago. South of and adjacent to the Commonwealth of

Hawaii	U.S. state. See MHI, NWHI. Composed of the islands, atolls and reefs of the Hawaiian Archipelago from Hawai'i to Kure Atoll, except Midway Islands. Capitol - Honolulu.
HDAR	Hawaii Division of Aquatic Resources. Also, DAR.
HIMB	Hawaii Institute of Marine Biology, University of Hawaii.
HURL	Hawaii Undersea Research Lab.
JIMAR	Joint Institute of Marine and Atmospheric Research, University of Hawaii.
IATTC	Inter-American Tropical Tuna Commission.
Ika-shibi	Hawaiian term for nigh tuna handline fishing method. Fishing for tuna using baited handlines at night with a nightlight and chumming to attract squid and tuna.
Incidental Catch	Fish caught that are retained in whole or part, though not necessarily the targeted species. Examples include monchong, opah and sharks.
Interaction	Catch of protected species, which is required to be released. Examples: Hawaiian monk seals, marine turtles and albatrosses.
Logbook	Journal kept by fishing vessels for each fishing trip; records catch data, including bycatch and incidental catch. Required in the federally regulated longline and crustacean fisheries in the Hawaiian EEZ.
Longline	Fishing method utilizing a horizontal mainline stretching from several hundred yards to many miles in length, suspended for the surface by floats, to which droppers with baited hooks are attached.
Longliner	Fishing vessel specifically adapted to use the longline fishing method.
MFCMA	Magnuson Fishery Conservation and Management Act of 1976. Also, Magnuson-Stevens Fishery Conservation and Management Act of 1996. Sustainable Fisheries Act.
MHI	Main Hawaiian Islands (comprising the islands of Hawai'i, Mau'i, Lana'i, Moloka'i, Kaho'olawe, O'ahu, Kauai', Ni'ihau and Ka'ula).
MSY	Maximum Sustainable Yield.
NMFS	National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce. Also NOAA Fisheries.
NOAA	National Oceanic and Atmospheric Administration, Department of Commerce.
NWHI	Northwestern Hawaiian Islands. All islands in the Hawaiian Archipelago, other than the Main Hawaiian Islands (MHI).
OFP	Oceanic Fisheries Program of the South Pacific Commission.
OY	Optimum Yield.
Palu-ahi	Hawaiian term for day tuna handline fishing. Fishing for tuna using baited handlines and chumming with cut bait in a chum bag or wrapped around a stone. Also, drop-stone, make-dog, etc.
PAO	Pacific Area Office, National Marine Fisheries Service. Also, NMFS/PAO.
Pelagic	The pelagic habitat is the upper layer of the water column from the surface to the thermocline. The pelagic species include all commercially targeted highly migratory species such as tuns, billfish and some incidental-catch species such as sharks, as well as coastal pelagic species such as akule and opelu.
PFRP	Pacific Pelagic Fisheries Research Program, JIMAR, University of Hawaii. Also PPFRP.

PMUS	Pacific Pelagic Management Unit Species. Also, PPMUS. Species managed under the Pelagics FMP.
Pole-and-Line	Fishing for tuna using poles and fixed leaders with barbless lures and chumming with live baitfish. Poles can be operated manually or mechanically. Also, fishing vessels called baitboats or aku-boats (Hawaii).
Protected	Refers to species which are protected by federal legislation such as the Endangered Species Act, Marine Mammal Protection Act, and Migratory Bird Treaty Act. Examples: Black-footed and Laysan albatrosses, marine turtles, dolphins.
PT or PPT	Pelagic Plan Team. Advisory body to the Council composed of scientists and fishermen who monitor and manage the fisheries under the jurisdiction of the Pelagics FMP.
Purse seine	Fishing for tuna by surrounding schools of fish with a very large net and trapping them by closing the bottom of the net.
Recreational	Recreational fishing for sport or pleasure, where the catch is not sold, bartered or traded.
SAFE	Stock Assessment and Fishery Evaluation, NMFS.
Sanctuary	Protected area. Commercial/recreational fishing may be restricted.
Secretary	When capitalized and used in reference to fisheries within the U.S. EEZs, it refers to the U. S. Secretary of Commerce.
Small pelagics	Species such as akule (big-eye scad - *Selar* spp.) And opelu (mackerel scad - *Decapterus* spp). These fish occur mainly in shallow inshore waters but may also be found in deeper offshore waters. Not part of the PMUS.
SPC	South Pacific Commission. A technical assistance organization comprising the independent island states of the tropical Pacific Ocean, dependant territories and the metropolitan countries of Australia, New Zealand, USA, France and Britain.
SPR	Spawning Potential Ratio. A term for a method to measure the effects of fishing pressure on a stock by expressing the spawning potential of the fished biomass as a percentage of the unfished virgin spawning biomass. Stocks are deemed to be overfished when the SPR<20%.
SSC	Scientific & Statistical Committee, an advisory body to the Council comprising experts in fisheries, marine biology, oceanography, etc.
Trolling	Fishing by towing lines with lures or live-bait from a moving vessel.
USCG	U.S. Coast Guard, 14th District, Department of Transportation.
USFWS	U.S. Fish & Wildlife Service, Department of Interior. Also, FWS.
VMS	Vessel Monitoring System. A satellite based system for locating and tracking fishing vessels. Fishing vessels carry a transponder which can be located by overhead satellites. Two-way communication is also possible via most VMS systems.
WPacFIN	Western Pacific Fishery Information Network, NMFS.
WPRFMC	Also, the Council. Western Pacific Regional Fishery Management Council. One of eight nationwide fishery management bodies created by the Magnuson Fisheries Conservation and Management Act pf 1976 to develop and manage domestic fisheries in the U.S. EEZ. Composed of American Samoa, Guam, Hawaii, and Commonwealth of Northern Mariana Islands.